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# SARCOMA OF THE FEMALE BREAST;

## BASED UPON A STUDY OF ONE HUNDRED AND FIFTY-SIX CASES.

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IN my *Treatise on Tumors of the Mammary Gland*, published in 1880, may be found a chapter on sarcoma, in which the general pathology and life-history of the affection are deduced from an analysis of sixty cases confirmed by microscopical examination. This account remains up to the present time the most trustworthy description of this neoplasm with which I am acquainted; and it constitutes the only one in which an attempt has been made upon anything approaching an extended scale to determine the relations which exist between its minute features and its clinical characters. Feeling that many points were still obscure, I have, during the past seven years, kept a careful record of my own cases, and noted those reported by other surgeons, so that my collection now embraces one hundred and fifty-six cases,[1] including nineteen of my own, a critical examination of which affords the data for this paper.

The varieties and subvarieties of sarcoma of the female mamma are the same as those met with in other organs. The principal ones—the spindle-celled, round-celled, and giant-celled—are determined by the

[1] I have to express my thanks to Dr. Sands, Dr. Markoe, and Dr. Bull, of New York, and Mr. Bryant, of London, for unpublished cases from their practice, and to Mr. Henry Morris, of London, Mr. Humphry, of Cambridge, Mr. Banks, of Liverpool, Mr. Whitson, of Glasgow, and Mr. Page, of Newcastle-on-Tyne, for the final histories of their recorded cases.

prevailing form of the cells, and the first two are further separated, in accordance with the dimensions of the cells, into the small-celled and large-celled. The subvarieties are constituted by the nature or arrangement of the intercellular substance; by various transformations or combinations with other neoplastic tissues; by the presence or absence of duct or retention cysts; and by the persistence of glandular elements. Hence the modified forms of sarcoma are the fibrous, lymphoid, alveolar, myxomatous, cartilaginous, osteoid, calcifying, melanotic, telangiectatic, hemorrhagic, cystoid, solid, cystic, and adenoid.

Of the varieties of sarcoma, the spindle-celled, which include the fibrous, constitute 68 per cent., the round-celled 27 per cent., and the giant-celled 5 per cent. of all cases.[1] Of the subdivisions, 50 per cent. are cystic, the term including the barren and proliferous cysts; 50 per cent. are solid or noncystic; 33 per cent. are adenoid, the glandular structures persisting principally in the spindle-celled growths; 12.80 per cent. are myxomatous, the combination being almost peculiar to the spindle-celled and cystic tumors; 7.69 per cent. are telangiectatic and hemorrhagic; 7 per cent. are cystoid, or the seat of softening cysts; 2.56 per cent. are osteoid; 2.56 per cent. are calcifying; 1.21 per cent. are cartilaginous; 1.92 per cent. are alveolar; 1.21 per cent. are lymphoid; and 1.21 per cent. are melanotic or pigmented. It is interesting to note that in the ten examples of calcification, chondrification, and ossification, the tumors were spindle-celled in seven, and cystic in five. In the three cases of alveolar sarcoma the tumor was round-celled in two, and giant-celled in one; while both of the pigmented growths were alveolar and round-celled.

Like the other encapsuled neoplasms of the mamma, circumscribed sarcomata are ovoid, rounded, or spherical, lobed or bossed, and seldom smooth and uniform, the surface irregularities being most marked in the cystic variety. As a rule, they are unattached to the gland, but push it aside, compress, and flatten it, or cause it to atrophy, although they are, in rare instances, united to it by a pedicle. Their consistence varies with their minute structure and degenerations, the pure spindle-celled and giant-celled tumors being firm, like fibromata, while the round-celled are soft and elastic. The spindle-celled, however, are soft in about one-third of all examples, when they will be found to be composed of small fusiform cells, or to have undergone myxomatous or fatty transformation, or to be the seat of interstitial hemorrhage. The round-celled are hard in about one-sixth of all cases, when they will usually be found to be rich in

[1] Of the nineteen cases that have come under my personal observation, thirteen were spindle-celled and six round-celled. Of the former, five were firm, small adenoid growths; one was a telangiectatic and myxomatous, and one a myxomatous medullary sarcoma; six were firm cystic, and in two of these the cysts were filled with vegetations. Of the six round-celled, one was lymphoid; one was a myxomatous cystic medullary growth; two were proliferous cystic, and one of these was medullary, and two were cystoid medullary tumors.

fibrous intercellular substance. In one of the best illustrations of round-celled tumors that I have ever seen, the tissue was dense, so that they are by no means synonymous with soft, medullary, or encephaloid sarcomata, although they are usually much softer than the spindle-celled variety, since they are peculiarly rich in cells and bloodvessels, and since their intercellular substance is usually mucoid. The spindle-celled growths sometimes creak or cry under the knife, in which event they come under the category of fibrous sarcomata, from the large admixture of fibrous tissue. Their consistence varies, moreover, with their stage of development. If they are solid, it is entirely or almost uniform; while they are soft and elastic, or soft and fluctuating at some points, and especially at the larger bosses, and hard at others, when they are the seat of cysts occupied by fluid, or solid contents, or by both. In about one-fourth of the cystic growths, however, the tumor is firm throughout, in consequence of the cysts being so deeply seated as to elude detection by manipulation.

On section the spindle-celled tumors are usually smooth, succulent, and glistening, and of a white or grayish-white color, particularly if they are poor in vessels, the tint being rosaceous-white or rosaceous-gray when their vascular supply is larger. The round-celled tumors, on the other hand, are rarely pure white, but, from their relatively greater vascularity, reddish-white, reddish-yellow, or reddish-gray, the hue being not infrequently comparable to that of the fœtal brain. When they are highly vascular the rosaceous tint is very marked, or they are pervaded by macroscopic vessels; or dotted with minute spots of ecchymosis, or patches, or streaks of bright red or brown, or various intermediate shades of pigmentation. In not a few instances the soft brain-like tissue is so extensively interspersed with clots of blood, and with tomentous cysts containing blood, that the term hematoid or hemorrhagic sarcoma is not inappropriately applied to them, or the term fungus hematodes when they protrude through the skin. A pronounced yellowish color indicates fatty metamorphosis, which may pervade almost the entire tumor, or be confined to limited areas or to the vegetations alone, while the remainder is white or gray, thereby imparting to it a mottled aspect. A yellowish tint also denotes myxomatous changes, so that, as in the former instance, the mass of the growth may be white, or rosaceous-white, or rosaceous-gray, and the vegetations be yellow. On the whole, however, gelatinous spots dotting the surface of the section are the best characteristic of this change. Now and then, or when great vascularity and the fatty and myxomatous degenerations are combined, there will be areas of yellow and red, and spots of brown pigmentation, along with gelatinous dots. In point of fact, the color is so variable that it is extremely difficult to give an intelligible description of it. It need scarcely be added that melanotic sarcomata are pervaded by areas of

dark brown or black pigmentation. The cut surfaces of many of the largest specimens have also a lobed appearance from the close packing of the vegetations in the enlarged ducts which play the part of capsules.

The gross characters of the smaller tumors, which correspond to the adenoid sarcomata of Billroth, and which do not grow larger than a walnut in seven or eight months, are worthy of notice, as they differ from fibromata of the same dimensions in several particulars that are useful in establishing a differential diagnosis. Thus, of the five specimens of adenoid spindle-celled growths which I have extirpated, all were lobulated, firm, elastic, adherent to the gland, grayish-white in color, and tough on section. The fibromata, on the other hand, were hard, merely nodular, less adherent to the mamma, white, and more compact and tough on section. Under the microscope, the glandular elements were undergoing obliteration to a greater extent in the former than in the latter.

Inflammation and suppuration of mammary sarcoma are infrequent, but ulceration of the overlying tissues is so common that it occurred in twenty-nine, or 18.59 per cent., of the one hundred and fifty-six cases that I have collated, a proportion which is more than double that met with in fibroma. As is witnessed in the latter tumor, the ulceration appears to be the result rather of inflammation and gangrene, or merely rupture, of the attenuated skin, than of its infiltration by sarcomatous cells; but in one case it depended upon exploratory puncture. In some examples it is, doubtless, due to invasion of the skin, but only one case, that of a crater-like ulcer, appears to have originated in this way. In 10 per cent. of the cases the ulcer presents itself in the form of a sloughing patch. Fungous protrusion almost invariably follows the perforation of the integuments, although in a remarkable instance recorded by Ashhurst,[1] the recurrent growth of which I exhibited at the Pathological Society, the ulcer subsequently healed. The protruding mass, which is usually an intracystic growth, varies in size from a hazelnut to three, four, and even five inches in diameter, and exhales a sanguinolent and fetid discharge, which may become more or less purulent from inflammation induced by exposure and friction. It is not, however, very prone to free hemorrhage or sloughing. The ulcer itself is usually circular, and the surrounding skin is not only, as a rule, free from discoloration, but it is also unattached to the fungus, and everted, or rather elevated, on its sides. Now and then there are several ulcers, separated by bridges of sound tissue. From a diagnostic standpoint, it is worthy of notice that ulceration occurred in 7.69 per cent. of solid sarcomata, against 18.76 per cent. of cystic sarcomata, and that it was met with in 25 per

[1] Trans. Path. Soc. Phila., vol. v. p. 230.

cent. of the giant-celled, 23.58 per cent. of the round-celled, and 17.58 per cent. of the spindle-celled tumors.

Sarcomata of the breast are generally solitary, since I find of one hundred and fifty-six cases that only ten were multiple, several growths existing in one gland in seven and in both glands in two, while in the tenth instance four tumors were present in one breast, and one tumor was found in its fellow. Their most common seat is in the vicinity of the nipple, and, when they arise from the circumference of the organ, they are usually found at its upper and outer quadrant. When of central origin they are, for the most part, cystic; while they are usually solid when they start from outlying lobules. In either event they evince a marked disposition to extend beyond the limits of their capsules, those of central origin gradually invading the entire gland, and the surrounding soft parts, while the peripheral ones not only infect the latter structures, but also finally implicate the entire breast. As a rule they give rise to broadly based hemispherical tumors, but they are now and then pedunculated.

They occur as early as the ninth and as late as the seventy-fifth year, the average age of their first observation being 40.6 years. Of 148 cases in which the age is recorded,

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|---|---|---|---|---|---|---|
| 1 | appeared | at | 9 | years. | | |
| 14 | " | between | 10 | and | 19 | years. |
| 16 | " | " | 20 | " | 29 | " |
| 40 | " | " | 30 | " | 39 | " |
| 39 | " | " | 40 | " | 49 | " |
| 23 | " | " | 50 | " | 59 | " |
| 14 | " | " | 60 | " | 69 | " |
| 1 | " | at | 75 | years. | | |

Of the entire number only 4, or 2.70 per cent., occurred before the sixteenth year, or during the developmental state of the mamma; 67, or 45.27 per cent., appeared between the sixteenth and fortieth years, or at a period when the breast and genitalia are functionally most active; and 77, or 52.02 per cent., after the fortieth year, or during the period of their functional decline. Spindle-celled tumors develop earlier in life than the giant-celled and round-celled, since the average age at which they were noticed was 36 years and 7 months, against 47 years and 3 months for the giant-celled, and 48 years for the round-celled. Unlike cystic and solid fibromata, cystic sarcomata appear at an earlier age than solid sarcomata, the average for the cystic being 38 years and 5 months, against 43 years for the solid variety. Hence it may be said that spindle-celled and cystic sarcomata are metaplasias of the functionally perfect mamma, and round-celled, giant-celled, and solid sarcomata are metaplasias of the declining gland. In point of fact, the fifteen sarcomata occurring before the age of twenty were spindle-celled in fourteen.

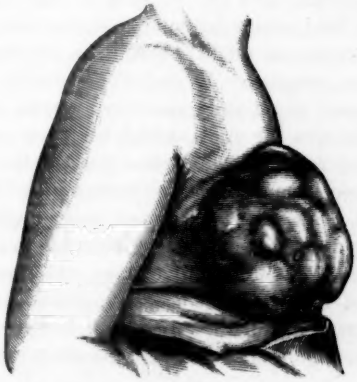
Thirty-three of the patients were single and fifty-seven were married when the tumor was first noticed, while the social condition is not noted in the remainder. Of the married women forty were multiparous, six had one child, and eight were barren; while the question of children is not stated in three. In two cases the disease showed itself during pregnancy, and in four soon after parturition. Of thirty-eight subjects in which the menstrual function is recorded, all were regular save one, who suffered from amenorrhœa. In seventeen instances, or one in every nine and one-third, injury was assigned as the cause of the tumor; in one it developed at the site of an abscess; in one it was preceded by psoriasis of the nipple; while in none was it inherited. These facts show that the etiology of sarcomata is most obscure, since their development is rarely traceable to injury or disease, and is not influenced by hereditary predisposition, while the social state and menstrual irregularities or arrest are surely unimportant agents in their production.

The increase of sarcomata is more rapid than that of the other connective tissue neoplasms, but it is liable to great diversity, being independent of the age of the subject, and influenced by their structure, by their degenerations, and by the absence or presence of cysts. Of the solid sarcomata I have met with six examples which varied from one to two inches in diameter in five, six, seven, and eight months; and, even at the end of two or three years, they may not be larger than an apricot[1] or a turkey's egg,[2] although they may, in their pure state, attain the volume of an adult head in four months,[3] or a circumference of twenty-five inches and a weight of four pounds and two-thirds in nine months.[4] When they are the seat of myxomatous degeneration or of softening cysts, they may weigh four pounds and twelve ounces,[5] or measure twenty-three inches in circumference and weigh six pounds, in four months.[6] Of the cystic, as of the solid, variety, I have seen examples in which it did not exceed a diameter of two inches in five and eight months; while it is rarely larger than a fist in one year. In exceptional instances, however, it may attain the volume of a double fist in three months,[7] or a weight of upward of ten pounds in the same number of months,[8] or a circumference of thirty-one inches and a weight of twelve pounds in one year.[9] As an evidence of its unequal rate of progress, we may state that it may require eighteen months,[10] five years,[11] eighteen

[1] Reverdin: Bull. de la Soc. Anat., t. xlii. p. 708, [illegible] t. xliv. p. 285.
[2] Zambianchi: Ibid., t. xlvi. p. 314.
[3] Billroth: Chir. Klinik, Wien, 1869-70, p. 142.
[4] Bryant: Trans. Path. Soc. London, vol. xix. p. 387.
[5] Bennett: Cancerous and Cancroid Growths, pp. 12 and 256.
[6] Hewson: Gross's System of Surgery, 6th ed., vol. ii. p. 974.
[7] Post: Medical Record, 1872, p. 112.
[8] Glück: Langenbeck's Archiv, Bd. viii. Jahresbericht, p. 599.
[9] Pitha: Ibid., p. 599.
[10] Hubert: Bull. de la Soc. Anat., t. xlviii. p. 690.
[11] Reverdin: Ibid., t. xliv. p. 281.

years,[1] or forty years[2] to reach the volume of a fœtal head, or six years[3] or fifteen years[4] to attain the size of an adult head.

Like the cystic fibromata, sarcomata may remain stationary and of small dimensions for a long time, when, without obvious cause, they suddenly begin to increase, so that a nodule that has required fifteen years to attain the volume of a walnut reaches that of a double fist in three months;[5] or one which has remained the size of an egg for eighteen years, acquires the volume of an adult head in a few months;[6] or one that has been quiescent and of the size of a walnut for twenty-five years, suddenly begins to grow, and measures eighteen inches transversely by fourteen inches and a half vertically in three years;[7] or one that has been a year and a half in acquiring the volume of an egg grows to a circumference of twenty-six inches, and a weight of seven pounds in an additional six months.[8] In such cases rapid accumulation of fluid and solid contents in the dilated ducts may be looked for; or the increase in volume may be due to myxomatous changes and interstitial hemorrhage. Under similar circumstances their progress may be interrupted, of which I recently met with a notable example. On the 11th of November, 1886, I removed a proliferous cystic small spindle-celled tumor from a lady of sixty-five. At the age of twenty-five, she accidentally observed a tumor as large as a chestnut at the inner side of the right nipple. It remained



of that size until the age of sixty-one, when it began to grow, and during the past year had doubled its volume, so that it was larger than a fœtal head. Its gross characters are shown in the illustration, and the breast

[1] Pick: Trans. Path. Soc. London, vol. xx. p. 347.
[2] A personal case.
[3] Hubert: Ibid., t. xlvii. p. 389.
[4] Berbèze: Ibid., t. xli. p. 94.
[5] Marignac: Bull. de la Soc. Anat., t. lii. p. 428.
[6] Tillaux, quoted by Cordier: Thèse de Paris, 1880, No. 404, p. 16.
[7] Anderson: Trans. Path. Soc. London, vol. xxiii. p. 254.
[8] Marchand: Gaz. des Hôpitaux, 1869, No. 51, p. 196.

measured seven inches more in circumference than its fellow. Robin[1] has recorded a case in which a vegetating myxomatous spindle-celled tumor remained of the size of a hazelnut for six years, when it grew continuously for four years, and reached the volume of a fist, and then doubled its size in three years and a half, and during the last six months, or fourteen years from its first appearance, attained a weight of nine pounds. Tillaux[2] extirpated a cystic tumor which grew from the size of a filbert to a hen's egg in three years, at which size it remained stationary for four years, when in six months it acquired the volume of an adult head. Although these seven cases were examples of cystic tumors, their peculiar histories countenance the view held by Billroth, Labbé[3] and Coyne,[4] König,[5] Duplay,[6] and myself, that fibroma is frequently metamorphosed into sarcoma through multiplication of its cells and increased vascularization. The opponents of this view of a change of type may urge that a sarcoma may remain latent for many years, when, without obvious cause it begins to grow rapidly; but there is certainly no reason why a fibrous tumor should not serve as the mother tissue of a sarcoma as well as ordinary fibrous tissue. Be this as it may, a long period of quiescence and intermission of growth are not infrequent in sarcoma, and are of diagnostic value when compared with the progress of other neoplasms of the breast. As occurs in fibroma, continuous growth rather indicates freedom from cysts and vegetations, while sudden and rapid increase points to fluid accumulation and intracanalicular vegetations.

The growth of sarcomata might naturally be expected to be connected with menstruation, pregnancy, or lactation, or with conditions which render the mammary gland more vascular; but the influence of an increased flow of blood to the organ, which has been assumed by certain authors, is not confirmed by an analysis of the cases that I have collected. Thus, in only three examples was an increase in bulk witnessed at the menstrual period, while in two the tumor became smaller. In one the rapid growth began during pregnancy, and in two at the menopause.

From these considerations it follows that, while sarcomata constitute the most bulky of the mammary neoplasms,[7] their growth is so capricious that an average rate of increase cannot be assigned to them. On the whole, however, one is justified in concluding that the small-celled,

[1] Journal de l'Anat. et de Phys., t. x. p. 195, and Bull. de la Soc. Anat., t. xlviii. p. 817.

[2] Cordier: Thèse de Paris, 1880, No. 494, p. 7.

[3] Chir. Klinik., Wien, 1871–76, p. 261.

[4] Traité des Tumeurs Bénignes du Sein., pp. 269, 283, and 363.

[5] Lehrbuch der Spec. Chirurgie, 4th ed., Bd. 11, p. 89.

[6] Traité Élément. de Path. Ext., par Follin et Duplay, t. v. p. 628.

[7] In his inaugural dissertation, Ueber Fibro-Adenom der Mamma, Göttingen, 1878, p. 13, Watson narrates a case from the practice of Kremer, in which the tumor weighed twenty-two pounds. Péan, in his Leçons de Clinique Chir., t. ii. p. 90, describes a myxomatous cystic spindle-celled sarcoma which weighed ten kilos, or more than twenty-six pounds, and a similar weight is recorded by Cordier, in his Thèse de Paris, No. 494, 1880, p. 40, from the practice of Tillaux.

the cystic, the myxomatous, and the telangiectatic increase more rapidly than the large-celled, the solid, and the pure tumors.

The active growth of the sarcomata is liable to be attended with marked elevation of the temperature, as was noted in two of my own cases, in one of which Seguin's surface thermometer indicated 100° against 95° for the opposite breast. In two other examples of cystic sarcoma there was an increase in the heat, as roughly estimated by the hand. All of these tumors were highly vascular and composed of small cells, so that elevation of the temperature may be said to be characteristic of telangiectatic and rapidly proliferating growths. Further investigations in this direction may prove useful in determining the differential diagnosis of the connective tissue neoplasms, and should not be neglected.

During their further progress sarcomata continue, as a rule, mobile and free from superficial or deep attachments; the contiguous structures are not invaded by tumor elements; the skin remains natural in color and texture; the subcutaneous veins are not enlarged; the nipple is normal; and the associated lymphatic glands are not contaminated. To these general statements some exceptions must be noted.

*a*. While it is not uncommon for recurrent tumors to be more or less closely fixed to the pectoral muscle, and through it to the walls of the chest, it is a singular fact that the primary growth is, almost without exception, freely movable, and rarely attached even to the common integument. In a case of spindle-celled tumor recorded by Zambianchi, and it was an example of two growths in the same breast, the outlying tumor developed over the upper costal cartilages to which it adhered, and sent a prolongation into the thorax.[1] In 6 additional instances, the muscles of the chest were involved in 5, and the parammary fat in 1. The tumor was cystoid spindle-celled in 1, cystic spindle-celled in 2, round-celled in 1, osteoid round-celled in 1, and cystic giant-celled in 1. Just how often the skin is invaded is difficult of solution, since in some of the cases of ulceration it was, doubtless, converted into sarcoma tissue, but microscopic data of this fact are wanting. Be this as it may, the skin was adherent in 15 examples, of which 10 were cystic, and 5 solid tumors, the round-celled slightly predominating. If, in addition to the cases of invasion of the muscles, perichondrium, and connective tissue, these 15 cases be regarded as instances of invasion by tumor elements, sarcomata of the breast are to be regarded as locally infectious in 14.19 per cent. of all cases.

*β*. Although the skin may be stretched and attenuated, and ulcerated,

[1] Ante: Lagrange and Duret (Bull. de Soc. Anat., t. xlviii. p. 516) refer to a case in which, on post-mortem examination of a female who had for many years an enormous sarcoma of the breast, the tumor separated the fibres of the pectoral muscles, passed between two ribs into the cavity of the mediastinum, and penetrated between and compressed the lobes of the lung, without infecting any of these structures.

as I showed in 18.59 per cent. of all examples, it was discolored in only 36, or in 23 per cent., and it is interesting to know that the changes in tint occurred twenty-seven times in the cystic and nine times in solid growths, three of which were the seat of degeneration-cysts, and that the round-celled tumors predominated. In twenty-one the tint was red, in four bluish, in ten violaceous, and in one livid.

γ. The superficial veins were enlarged in 24 instances, or in 15.39 per cent., but only to a slight extent in 2. In 18 the tumor was cystic, and in 6 it was solid, but in the latter it was the seat of extravasation of blood in one, and of mucoid cysts in the second. The spindle-celled growths predominated.

δ. The nipple was retracted or umbilicated in only 5, and these were examples of cystic growths.

ε. Of the 156 cases the lymphatic glands were enlarged, and now and then tender, in 19. In 14 of these the enlargement was associated with the primary growth, but in only 1, a case of alveolar pigmented round-celled sarcoma, were tumor elements detected.[1] In the remaining 5, the glands were extirpated along with recurrent growths, and in 2 of these, one an example of round-celled sarcoma communicated to me by Dr. Markoe, of New York, and the second a case of alveolar giant-celled tumor,[2] were they infected. Hence the glandular enlargement was due to irritative hyperplasia in 16, in 10 of which ulceration of the tumor was present, while they were infected in only 3. This immunity of the glands from contamination is remarkable, and is a valuable sign in the differential diagnosis of malignant mammary growths.

A discharge from the nipple is not met with in the solid tumors, but occurs in one case out of every nine and a half of cystic sarcomata, the proportion being smaller than is met with in cystic fibromata, and is of great value as a symptom of enlargement of the ducts, although it is of itself unimportant in the differential diagnosis. In two instances from the practice of Bryant,[3] the discharge was the first symptom, and preceded the detection of the tumor by three months in one and by two years in the other case. In a third case, recorded by that surgeon,[4] the flow was bloody, and derived from highly vascular vegetations. In the case of Hubert,[5] the tumor augmented in size at each menstrual period, when there was an occasional discharge of a citron-colored liquid. In the examples of Billroth[6] and Winslow,[7] in which the neoplasm developed during pregnancy, there was also a spontaneous escape of a serous fluid; while in those of Lebert[8] and Verneuil,[9] a viscid transparent liquid was expelled by pressure.

[1] Billroth: Die Krankheiten der Brustdrüsen, p. 56.
[2] Ibid., p. 58.
[3] Guy's Hospital Reports, ser. 3, vol. x. p. 115, and ser. 3, vol. xxviii. p. 468.
[4] Ibid., vol. x. p. 120.
[5] Bull. de la Soc. Anat., t. xlviii. p. 389.
[6] Chir. Klinik, Wien, 1869 and 1870, p. 142.
[7] Maryland Med. Journ., vol. 12, p. 243.
[8] Physiologie, Pathologique, t. ii. p. 128.
[9] Valude: Thèse de Paris, 1885, No. 91, p. 131.

The growth of sarcomata is attended with pain in 35.71 per cent. of all cases. In only 2.67 per cent., however, was attention first called to the tumor by suffering, and, in the remainder, it declared itself later, and varied in character and frequency in accordance with the variety of the sarcoma. Thus, in the solid form it was experienced in only 28 per cent. of the cases, and of these it was lancinating and continuous in 42.85 per cent., of an occasional darting character in 28.57 per cent., and lancinating and continuous only during the rapid increase of the tumor. In the cystic variety, on the other hand, it was felt in 41.93 per cent. of the cases, and in 69.23 per cent. of these it was, as a rule, severe and lancinating, and came on late in the disease, especially during rapid growth, when the tumor became tense through the increase of the contents of the cysts; while it was continuous and lancinating in 11.53 per cent., and slight in 19.23 per cent. In 14.28 per cent. of all cases it was only experienced when ulceration had set in, but ulceration and fungous protrusion provoked suffering in only 35.72 per cent. of all instances, and rarely increased it when it was previously felt. In one instance it was experienced only at the menstrual periods; while in three it was aggravated, and in one diminished, at that period. In only five cases was the growth absolutely tender, although in many examples it was annoying from its weight and bulk, so much so, indeed, in a case recorded by Pick, that the woman repeatedly tapped the cyst with a penknife to rid herself of these features.

During their further progress, as we have already seen, sarcomata may invade their limiting capsules and the neighboring tissues, and finally ulcerate. Without, however, of necessity pursuing this course, their capsules may remain intact, but none the less may they extend to the adjacent structures along the course of the bloodvessels, the adventitia of which is frequently the seat of small-celled proliferation, through which the tissues are converted into "latent zones of infection;" these zones are not appreciable by the naked eye, but serve not only as the points of departure of the recurrences that are so often witnessed after their removal, but also as foci of general infection with the production of deposits in the internal organs. Hence it is that the prognosis of sarcomata is eminently unfavorable, although there is still no little diversity of opinion among practical surgeons and pathologists on this point. Thus, Wilks and Moxon,[1] Cornil and Ranvier,[2] Labbé and Coyne,[3] and Erichsen[4] regard them, and particularly the cystic form, as being comparatively innocent, and only marked by a tendency to local reproduction. Labbé and Coyne and Erichsen deny the possibility of the general dissemination of spindle-celled tumors; and Erichsen,

[1] Lectures on Path. Anatomy, p. 584, 1875.
[2] Manuel d'Histologie Pathologique, p. 1162.
[3] Op. cit., p. 431.
[4] The Science and Art of Surgery, 8th Amer. ed., vol. ii. p. 710.

indeed, advances the doctrine that "the tendency to recurrence will, in most cases, gradually wear itself out, and after several operations have been required at intervals of months, or a year or two, the disease will cease to be reproduced, and a cure will be thus established;" although, he adds, that "instances are not wanting in which the tendency to the local reproduction of the sarcoma has been so active that it outran all possibility of complete extirpation, and eventually destroyed the patient." Virchow[1] states that, while sarcoma may recur in loco, "it is a tumor of limited malignity, but fully capable of producing metastases;" and Lücke[2] indorses this view. Birkett,[3] Gross,[4] Ashhurst,[5] Klebs,[6] Billroth,[7] Annandale,[8] Winckel,[9] and Agnew,[10] on the other hand, fully recognize the malignant attributes of sarcomata as denoted by their capability of reproducing themselves, not only in the neighboring tissues, but also in remote parts; and other writers regard their progress as being "much more favorable" than that of mammary carcinoma.

The greatest obscurity exists in regard to the cystic sarcomata, which include the tumors in which the dilated ducts are more or less closely filled with vegetations. This uncertainty is due to the fact that many English and German pathologists and surgeons class cystic adenomata, cystic fibromata, and cystic myxomata under the term cystic sarcoma. Marcus Beck,[11] the latest writer on the subject, indeed, denies the presence of duct cysts in sarcoma.

In 1880 I certainly established the fact that all the varieties of sarcoma of the breast are malignant; and a careful study of 92 of the 156 cases upon which this paper is based, and in which the final reports extend beyond the mere statement of the recovery or death of the patient, confirms this view.

Of the 92 cases only 1 ran a natural course, it being an example of round-celled tumor of both breasts, that proved fatal, with presumed secondary deposits, in seven months from the first appearance of the disease. The remaining 91 were subjected to the knife. Of these, 32 were well for periods which varied between one month and ten years and nine months; 42 were marked by local recurrence; in 8, not only was there regional reproduction, but metastases were found post-mortem; 3 recurred, with unmistakable evidences of general dissemination; 4 were characterized by metastases, and 2 by presumed metastases, without recurrence. In other words, 64.83 per cent. of these cases were endowed

[1] Op. cit., p. 362.
[2] Pitha and Billroth's Hdbch. der Allg. und Spec. Chir., Bd. ii., Abth. i., p. 194.
[3] A System of Surgery, edited by Holmes and Hulke, 3d ed., vol. iii. p. 451.
[4] System of Surgery, 6th ed., vol. ii. p. 973.
[5] Phila. Med. Times, vol. ix. p. 384, 1879.
[6] Op. cit., p. 1118.
[7] Die Krankheiten der Brustdrüsen, p. 60.
[8] Internat. Encyclop. of Surgery, vol. v. p. 842.
[9] Lehrbuch der Frauenkrankheiten, p. 754.
[10] Princ. and Pract. Surgery, vol. iii. p. 702.
[11] Dictionary of Practical Surgery, edited by Heath, p. 183.

with malignant features. Let us examine these general statements more in detail.

32 patients were alive and well for an average period of 49 months and 10 days after operation, the disease having existed, on an average, for 69 months and 11 days before surgical interference, so that the mean life of these subjects was nearly ten years. The period of freedom from recurrence was

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| From | 1 | to | 12 | months, | | in | 4 | cases.[1] |
| " | 1 | " | 2 | years, | | " | 4 | " |
| " | 2 | " | 3 | " | | " | 7 | " |
| " | 3½ | " | 4 | " | | " | 5 | " |
| " | 4 | " | 5 | " | | " | 5 | " |
| For | 7 | years | and | 3 | months | " | 1 | case. |
| " | 8 | " | | | | " | 1 | " |
| " | 9 | " | " | 11 | " | " | 1 | " |
| " | 10 | " | | | | " | 1 | " |
| " | 10 | " | " | 4 | " | " | 1 | " |
| " | 10 | " | " | 5 | " | " | 1 | " |
| " | 10 | " | " | 9 | " | " | 1 | " |

As has been seen, there was local reproduction in 53 cases. In 45, in which the date is noted, the periods of recurrence were as follows:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2 | cases | in | 3 | weeks. | 3 | cases | in | 12 months. |
| 2 | " | " | 1 | month. | 1 | case | " | 15 " |
| 7 | " | " | 2 | months. | 1 | " | " | 17 " |
| 3 | " | " | 3 | " | 2 | cases | " | 18 " |
| 2 | " | " | 3½ | " | 1 | case | " | 20 " |
| 2 | " | " | 4 | " | 1 | " | " | 21 " |
| 5 | " | " | 5 | " | 3 | cases | " | 24 " |
| 3 | " | " | 6 | " | 1 | case | " | 29 " |
| 1 | case | " | 7 | " | 1 | " | " | 32 " |
| 1 | " | " | 8 | " | 1 | " | " | 36 " |
| 1 | " | " | 9 | " | 1 | " | " | 48 " |

The table shows that more than one-half, or 57.7 per cent., of the reproductions took place in 6 months, while after 12 months there were only 13, or 28.8 per cent., and of these there were only 4, or 8.8 per cent., after 2 years. These statements lead to the belief that the chances for the patient are relatively good after the lapse of 2 years, and that the prognosis is all the more favorable as the period of freedom from signs of local contamination prolongs itself. As the latest date of reproduction was 4 years, we may assume that the 12 cases of the first table which remained well after the lapse of that time were permanently cured. The average date of recurrence was 10½ months, and the total life of these patients from the first observation of the disease to the final

[1] The shortest periods were 1 month, 4, 6, and 10 months.

report after the last operation was 7 years and 9 months. The number of recurrences, or operations for recurrence, was 1 in 23 cases, 2 in 13 cases, 3 in 7 cases, 4 in 1 case, 5 in 4 cases, 6 in 2 cases, 7 in 1 case, 12 in 1 case, and 22 in 1 case.

While the average was 10½ months, the histological constitution of the growth appears to have exerted a marked influence upon the date of recurrence. Thus, the average date of local reproduction was 4 months and 20 days for the round-celled, 11 months and 27 days for the spindle-celled, and 12 months and 10 days for the giant-celled. The cystic tumors recurred in 8 months and 5 days, and the simple in 13 months and 9 days, and this contrast becomes the more striking when we state that the average date of recurrence for cystic round-celled growths was 3 months and 4 days as against 6 months and 8 days for the simple round-celled, and 9 months for cystic spindle-celled as against 16 months for the simple spindle-celled.

Of the 91 cases metastatic growths, as demonstrated post-mortem, or by unmistakable evidences during life, had formed in 17, or 18.68 per cent. There can be no doubt that this estimate is too low, since of 20 examinations of persons dead from the effects of the primary operation, or dead after secondary operations, metastatic growths were found in 12, or 60 per cent. The total duration of life from the first appearance of the primary tumor to the death of the 17 patients was 57 months, 9 months having been the shortest, and 25 years and 7 months the longest, period. The relative frequency of the seats of the secondary deposits is shown by the following statement:

| | | | |
|---|---|---|---|
| Lungs, | in 10 cases. | Pleura, | in 1 case. |
| Liver, | " 4 " | Heart, | " 1 " |
| Brain, | " 3 " | Kidney, | " 1 " |
| Dura mater, | " 1 case. | Muscles, | " 1 " |
| Retroperitoneal glands | " 1 " | Bones, | " 1 " |
| Mediastinum, | " 1 " | | |

The prognosis is materially influenced by the age of the patient and by the size and rate of increase of the tumor. Thus before the age of thirty-five, when the mammary gland is functionally most active, a small, slowly growing sarcoma does not return, while a rapidly increasing tumor, especially the cystic variety, is very liable to recur. Among the latter class of cases, 60.71 per cent. were characterized by recurrence, and 10.71 per cent. by metastatic tumors. Of these, the solid sarcomata recurred in 53.84 per cent., and gave rise to secondary growths in 7.69 per cent., while the cystic recurred in 66.66 per cent., and were marked by metastases in 13.33 per cent. It does not appear, however, as many writers assert, that the more tender the age the more rapid is the growth of, and the more malignant is, the neoplasm. Thus, of 15 cases, the ages of which varied from 9 to 19 years, or 16⅓ years on an average, the tumor had been in

existence on an average for 7½ years before its removal, and 28.57 per cent. remained well, while 71.43 per cent. recurred, and metastases were not observed in a single instance. After the thirty-fifth year, on the other hand, and the danger increases with advancing age, the greater is the liability to metastases, as in this class of cases 19.35 per cent. were generalized, and 43.54 per cent. recurred. Of these, the solid tumors recurred in 47.05 per cent., and gave rise to secondary growths in 23.54 per cent., while the cystic recurred in 44 per cent., and were marked by metastases in 16 per cent. of all cases. In other words, a sarcoma occurring in a functionally active breast evinces a marked disposition to recur after operation, with less disposition to metastases, while a sarcoma of the declining breast recurs less frequently, but is generalized in a greater number of instances.

The prognosis is also influenced by the histological constitution and the stage of evolution of the tumor. Of the spindle-celled 65.10 per cent. recur, and 20.40 per cent. give rise to metastatic growths; of the round-celled 60 per cent. recur, and 25 per cent. are generalized; of the giant-celled 57.14 per cent. recur, and in none are there metastases; of the solid 64.58 per cent. recur, and 25 per cent. are disseminated; while of the cystic 51.16 per cent. recur, and 11.62 per cent. are generalized. Hence, while the round-celled are the most malignant, the metastasis of the spindle-celled is by no means to be denied, nor can we say, with certain writers, that the cystic variety is an innocent tumor, or one of limited malignity, since it recurs in more than one-half of all cases, and generalizes itself in about one case out of every nine. These investigations demonstrate that the usual statements, which are so opposed to the actual facts, as to the malignity of sarcomata, are due either to their not having been based upon a careful analysis of a sufficient number of recorded cases, confirmed by minute examination, or to the confounding of cystic sarcomata with other cystic growths, which never infect the economy.

While I have been unable to collate cases in which the disease ran a natural course, through which we are deprived of data bearing upon the duration of life in this class of patients, and comparing them with the average duration of life of those subjected to the knife, there can be no doubt that operations do result in permanent recoveries, and prolong life, even if a final cure is not attained. From an inspection of the two tables on a previous page, it appears that recurrence may be delayed for four years, and that 12 subjects were alive and well after four years, so that if we take four years as the criterion of safety, the 91 operations show 13.18 per cent. of cures.

Although the recurrent regional disease is more intense than the primary, and other reproductions generally follow in quick succession, the removal of tumors as fast as they appear certainly alleviates suffer-

ing, prolongs life, averts visceral contamination, and occasionally brings about a cure. Thus, Bryant[1] removed the entire breast for a round-celled sarcoma on January 9, 1883, and up to February 10, 1886, performed twelve operations for multiple recurrent growths, the opposite breast being the seat of an atrophic scirrhus of sixteen years' standing. Billroth[2] enucleated a cystic sarcoma, and removed four recurrent growths in four years, the breast being extirpated at the last operation, and the woman was free from disease three years subsequently. Erichsen[3] extirpated the entire breast for a cystic growth of twenty-seven years' standing in 1859, and removed recurrent growths in 1861, 1863, 1864, 1865, and 1866, death ensuing from paralysis "some years after the last operation." In Heath's[4] case of removal of the gland for a spindle-celled tumor, six operations for recurrences were done in thirteen years, and the patient was alive with a seventh recurrence. In that of Haward,[5] a spindle-celled tumor was removed in 1860, and recurrent growths were excised in 1863, 1869, and 1873. The patient died, without metastases, from the effects of the last operation, but life was prolonged, as in the preceding instance, for thirteen years. Riedel[6] removed six recurrences in twenty years following an operation for giant-celled sarcoma, and on death there were no metastases. Gay,[7] in May, 1865, enucleated from the same breast two cystic spindle-celled sarcomata of six years' standing. Recurrent growths were removed in July, 1867, with the entire gland, in May, 1869, and May, 1874, in June, 1878, in May, 1880, and in June, 1881, so that life was extended for fourteen years, and the woman was still living at the date of the last report. The case of S. D. Gross,[8] however, is, so far as I know, the most remarkable on record. In March, 1857, a single woman, aged forty-four, discovered a small tumor in the left breast, which, on enucleation the following October, proved to be a small spindle-celled sarcoma. During the next sixteen months two more partial operations were performed, and a fourth tumor, along with the entire breast, was extirpated in May, 1859. In three months and a half the knife was again required, and soon afterward other tumors were removed. In 1860 she underwent eleven operations, and six in 1861, the last of which was performed in September of that year, so that she was subjected to twenty-two operations for fifty-one recurrent tumors in four years. They varied in size from an almond to a hen's egg; appeared at or near the cicatrices in a few weeks, and rapidly assumed a fungating

[1] Private communication, March 6, 1886.
[2] Die Krankheiten der Brustdrüsen, p. 68.
[3] The Science and Art of Surgery, 8th Amer. ed., vol. ii. p. 711.
[4] British Medical Journal, 1878, vol. i. p. 194.
[5] Trans. Clin. Soc. London, vol. vii. p. 106.
[6] Centralblatt für Chirurgie, 1881, Bd. 8, p. 636.
[7] Trans. Path. Soc. London, vol. xvi. p. 240; vol. xx. p. 359; vol. xxv. p. 233; vol. xxxi. p. 272; and vol. xxxiii., Suppl. p. 24.
[8] A System of Surgery, 6th ed., vol. ii. p. 974.

aspect. Large portions of the pectoral, and also of the external and internal intercostal muscles were cut away, so that during a deep inspiration there was a slight protrusion of the pleura. Ten years and nine months after the last operation she was in perfect health. In these eight cases there was no lymphatic involvement, and the general health was unimpaired.

A study of the preceding facts shows that, like carcinoma, sarcoma is a malignant growth. It differs, however, from the former in many important features, which are shown in the following statement:

| | Sarcoma. | Carcinoma |
|---|---|---|
| Invasion of the skin by tumor elements | 9.67 per cent. | 68.92 per cent. |
| Invasion of the chest walls | 3.87 " | 21.58 " |
| Invasion of the parammary connective tissue | 0.64 " | 8.39 " |
| Primary invasion of the axillary glands | 0.64 " | 67.35 " |
| Local reproduction after removal | 58.24 " | 80.97 " |
| Metastases found post-mortem | 60.00 " | 50.00 " |
| Average duration of life | 81 months. | 39 months. |
| Permanent cures | 13.18 per cent. | 10.39 per cent. |

From this table it appears that sarcoma is less infectious locally, but more infectious as regards the general system, than carcinoma. Its more relatively benign character is shown not only by the larger proportion of cures, but also by the fact that the average duration of life, from the first observation of the disease to the date of the last removal after operation, is forty-two months longer; and this contrast becomes the more striking when it is stated that the majority of the sarcomatous patients were still living, and the majority of the carcinomatous subjects were dead. Not only is this statement true for sarcomata in general, but it holds good for the three varieties, since the average life for round-celled sarcoma is fifty-four months, ninety months for the spindle-celled, and one hundred and eight months for the giant-celled.

The diagnosis of small, slowly increasing fibrous sarcomata is by no means easy, as they are very liable to be confounded with fibromata, particularly when they arise at the circumference of the mamma. A tumor, however, of soft, apparently fluctuating consistence, with elevated temperature, conveying the impression of an abscess, and occurring in young women, which attains a large volume in a few months, can scarcely be anything else than a medullary sarcoma. On the whole, the diagnosis is based upon their indolent origin, mobility, elastic, or unequal consistence, lobulated outline, rapid increase, freedom from lymphatic involvement, their tendency to ulcerate, the not infrequent discoloration of the skin, and enlargement of the subcutaneous veins, and, possibly, elevation of temperature; upon the suffering which they awaken late in the disease; and upon their greatest frequency after the fortieth year.

The only tumors met with before the age of sixteen are fibromata and

sarcomata, the former being twice as common as the latter. The fibromata are always solid, and grow slowly, while the sarcomata are cystic in three-fourths of all instances, and medullary in the remaining fourth, and, as a rule, grow rapidly. Hence cystic and medullary tumors at this period of life are sarcomata and nothing else.

Between the spindle-celled, round-celled, and giant-celled there are some marked similarities which render their differentiation difficult. The spindle-celled, however, are characterized by their development at a comparatively early age; by the attendant suffering; by the enlargement of the subcutaneous veins; by their slow reproduction after removal; and by their long life. The round-celled, on the other hand, appear, as a rule, at a comparatively late age, and are painless; but the skin is liable to be discolored and ulcerated, and recurrence is rapid, and the duration of life is relatively short. The giant-celled likewise appear late in life, but are painful; discoloration of the skin and ulceration are also common; but there is no enlargement of the veins, while irritative enlargement of the axillary glands is frequent. Local reproduction is delayed longer than in the other varieties, and the duration of life is remarkable.

These points are set forth in the following table, in which the affinities and contrasts of the three principal varieties may be seen at a glance:

| | Spindle-celled. | Round-celled. | Giant-celled. |
|---|---|---|---|
| Average age of appearance | 36 years. | 48 years. | 47 years. |
| Appear before 16th year | 12.08 per ct. | 0.83 per ct. | 0 per ct. |
| Pain | 60.00 " | 10.81 " | 43 " |
| Skin discolored | 20.88 " | 32.35 " | 25 " |
| Ulceration | 17.58 " | 23.58 " | 25 " |
| Veins enlarged | 17.58 " | 11.76 " | 0 " |
| Glands swollen | 6.59 " | 8.82 " | 37.5 " |
| Glands infected | 0. " | 2.94 " | 0. " |
| Adjacent tissues invaded | 13.18 " | 17.64 " | 25 " |
| Local reproduction | 65.10 " | 60. " | 57.14 " |
| " " average date of | 12 months. | 4½ months. | 12½ mos. |
| Metastatic deposits | 20.40 per ct. | 25 per ct. | 0 per ct. |
| Average life with operation | 90 months. | 54 months. | 108 mos. |

Between the solid and cystic varieties there are certain distinctions, which are useful in establishing a differential diagnosis. The former develop at about the forty-third year; the skin is discolored in 11.53 per cent; ulceration occurs in 7.69 per cent.; the veins are dilated in 7.69 per cent.; there is no discharge from the nipple, nor is it retracted; pain is met with in 28 per cent.; the surrounding tissues are invaded by tumor elements in 11.54 per cent.; the lymphatic glands are enlarged in 11.54 per cent., and infected in 1.28 per cent.; recurrence ensues in 64.58 per cent., and metastatic growths are met with in 25 per cent. of all instances. Cystic sarcoma starts, as a rule, at the thirty-eighth

year, and is not, as is asserted by many writers, most common between twenty and thirty-five years, as just as many cases occur after as before the latter age; it grows more rapidly than the solid variety, and its increase is often sudden after having remained stationary or advanced slowly for some time. Now and then, after evacuation of the fluid of the superficial cysts, their solid contents can be detected by manipulation; their consistence is, as a rule, unequal, and they are more largely lobulated than the former variety. The skin is discolored in 34.61 per cent.; the tumor ulcerates in 18.76 per cent; the veins are enlarged in 23.07 per cent.; the nipple is retracted in 6.41 per cent., and discharges fluid in 10.25 per cent; pain is experienced in 41.93 per cent.; the adjacent tissues are infected in 16.66 per cent.; the lymphatic glands are swollen in 5.12 per cent., but they are never invaded by tumor elements; while it recurs in 51.16 per cent., and becomes generalized in 11.62 per cent. of all cases.

There are no signs by which cystic sarcomata can be absolutely differentiated from cystic fibromata, with which they are so frequently confounded. The latter develop earlier in life, and a discharge from the nipple is more common than in the former; but ulceration and enlargement of the veins are only one-half as frequent, and they are not attended with glandular enlargement or malignant features. It should, however, be stated that the largest proliferous cystic tumors met with in old, married multiparæ are generally sarcomata

As no attempt has hitherto been made to describe the life history of the giant-celled variety, and some of the modified forms of mammary sarcoma, the following facts will be found to be not devoid of interest.

In 8 cases of giant-celled tumors that I have collated, the average date of their first observation was 47¼ years, or at the ages, respectively, of 42, 45, 45, 46, 46, 49, 50, and 55. Of the 6 cases in which the social condition is noted, 3 were married, of which 2 were parous, and 3 were single. The tumors were solid in 6, of which one was alveolar, and cystic in 2. The skin was violaceous in tint and adherent in one case of cystic tumor, and red and stretched in one of solid tumor. In one of the cystic tumors there was firm attachment to the great pectoral muscle. Ulceration was met with in 3, of which 2 were solid and 1 was cystic. The axillary glands were enlarged but not infected in 3 cases, 2 of which were cystic and 1 was solid, and enlarged lymphatic glands were detected in 3 cases of recurrence of solid tumors, in 1 of which, an alveolar growth, they were invaded by tumor elements.

All of the cases were subjected to the knife. In 1 the history ceases with the operation.[1] In 3 there was no recurrence, and the patients were alive subsequently for ten years and five months,[2] three months,[3]

[1] Estlander: Rev. Mens. de Méd. et de Chir., 4, 1880, p. 795.
[2] Ibid., p. 796.
[3] Lancereaux: Bull. de la Soc. Anat., t. xxxv. p. 292.

and ten years.[1] In 4 the tumor recurred. In Billroth's[2] case, a reproduction, with infected glands, was removed in two months, and another similar operation was performed in a few months. The patient died of erysipelas, but metastases were not found post-mortem. In the case of Riedel,[3] six recurrent growths were removed in twenty years, and on death it was found that the patient was free from metastases. In the case of Estlander,[4] a recurrent growth, along with the glands of the axilla, was removed in two years and five months, and the patient was well five years and nine months subsequently; while in the case of Stanley,[5] the patient died with a recurrent tumor in two years after the extirpation of the breast. The average total duration of life of these patients from the first observation of the disease to the final report was nine years.

It will thus be seen that giant-celled, or myeloid, sarcoma sets up irritative enlargement of the lymphatic glands in 37.5 per cent. of all cases; that the skin is discolored, the tumor ulcerated, and the surrounding tissues are infected in 25 per cent.; that the subcutaneous veins and nipple are normal; and that, while it recurs in 57.14 per cent., it never gives rise to metastatic growths.

Osteoid sarcoma, or the variety which contains true osseous tissue, has been met with at the ages of 27, 46, 49, and 51 years, the average being 43 years. It occurs usually in married multiparæ; as a rule grows slowly; is hard, except when it has undergone cystoid degeneration; acquires large dimensions in one-half of the cases, and is painful during its rapid growth. It ulcerates in one-fourth of all instances; invades the adjacent tissues in one-half; does not infect the lymphatic glands, nor is it marked by dilatation of the superficial veins.

The case recorded by Durham[6] is devoid of further history. Of the three reported by Stilling,[7] in which an operation was practised, one died in twenty-three months, without recurrence, but with evidences of metastatic growths in the lungs and pleuræ; one died of pneumonia on the third day, with secondary tumors of the lungs, and sarcomatous thrombosis of the veins of the pectoral muscle, the disease having existed for eighteen months; and the third was characterized by two local reproductions, and a metastatic growth of the left ventricle of the heart, about sixteen weeks after the primary operation, the total life having been ten years and four months. The average life of these cases from the first observation of the disease until its termination was fifty-seven months, and the average life after operation was thirteen months and a

[1] Paget: Trans. Clin. Soc. London, vol. vii. p. 108.
[2] Die Krankheiten der Brustdrüsen, p. 58.
[3] Centralblatt für Chirurgie, 1881, No. 40, p. 636.
[4] Ut supra.
[5] Paget: Lect. on Surg. Path., 3d ed., p. 555.
[6] Trans. Path. Soc. London, vol. xxxv. p. 378.
[7] Deutsche Zeitschrift für Chirurgie, Bd. xv. pp. 247-253.

half. Hence, metastases occurred, or were presumed to have occurred, in all the cases, and of those who survived the knife local reproduction was witnessed in one-third, and a recurrent growth would certainly have been formed if the patient with sarcomatous pectoral veins had survived. From these considerations, osteoid sarcoma must be regarded as the most malignant of the mammary sarcomata.

The life history of pigmented alveolar round-celled sarcoma can only be based upon two cases. In that of Billroth,[1] a hard tumor, of three years' duration, as big as a child's head, and adherent to the skin, was removed, along with infected glands, from a multipara sixty-five years old. The patient died of exhaustion, without recurrence, in eight months, but there was no post-mortem examination. In the case of Butlin,[2] a tumor of seven years' standing was removed, in 1880, from the otherwise normal breast of a woman of fifty-eight. Recurrent growths were extirpated in 1882, 1884, and 1886, but the history ceases with the last operation. In addition to these cases, Wacker[3] describes a case of multiple melanotic alveolar round-celled sarcoma of both breasts, with infection of the glands of the left axilla, and metastatic tumors of the spleen, mesenteric glands, and brain. The disease was thought to be secondary to melanotic sarcoma of the skin of the mammæ. Winckel depicts a proliferous myxomatous melanotic sarcoma, but the case is devoid of history.[4]

The treatment may be summed up in a few words. The entire breast, along with any skin that may be invaded, must be extirpated, especial care being paid to the complete removal of every particle of parammary fat and the fascia of the pectoral muscle, in which tissues experience shows that recurrence takes place. In the event of repullulation the growths should be freely excised as fast as they appear, as such a practice not only prolongs life, but may bring about a final cure.

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## ON THE REMEDIAL VALUE OF BLOODLETTING.

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It has often seemed to me a matter of regret that a remedy of such unquestionable power as bloodletting should, from former abuse, be reckoned by many as among the things of the past, and that it should have run the risk of being denied all virtue, because of some inherent

[1] Op. cit., p. 56, fig. 57.
[2] Lancet, January 8, 1887, p. 72.
[3] Inaug. Disser., Rostock, 1884, p. 15.
[4] Lehrbuch der Frauenkrankheiten, p. 756.

faults, which, however, are quite capable of compensation. Its very power, and the exact results which in fitting cases attend its employment, doubtless led to its indiscriminate use, and, inasmuch as it is spoliative in its nature—a power fraught, it may be, with the greatest evil—it is not difficult to see how readily it might be abused. The dangers attaching to this abuse once fully recognized, the extreme oscillation was readily foretold, for in medicine, as in the sciences, which are—maybe—more exact, the pendulum of opinion swings freely and its resting points may be very widely distant.

Bloodletting is not the only form of treatment to which time and increase in knowledge have carried wise modifications. Thirty years ago there developed what many now regard as a craze for alcohol-giving, and when we note the position it held then, and call to remembrance that which it holds now, we may almost cherish a hope that a power as valuable, and not more difficult to handle, may again take a recognized position as a valuable remedy. With that greater skill which is undoubtedly ours, with that more intimate acquaintance with physiological and pathological processes, we are better able to judge the exact capability of such a remedy, and when we recognize in it the power to modify the distribution of the blood, and to diminish pressure within the vascular system, then we are moving on such lines as are well fitted to guide us in its employment. That it can do more than these things is probable. That it does act as a derivative, that it is a powerful though dangerous sedative, and that its employment facilitates the action of other remedies is all possible, and, although I believe that few would incline to employ it for such ends solely, its possession of such potentialities may render it of wider service than we anticipate when we use it.

Maybe the strongest objection to its employment lies in the dread that by the abstraction of blood we tend directly to weaken our patient; but this fear is, I am sure, exaggerated. Several observers, among others Sir James Paget, believe that bloodletting in limited quantity is attended with little risk of immediate or remote injury, and a physician of such eminence and ability as William Pulteney Alison states "that the idea of subsequent injury to the constitution from the use of bloodletting in inflammatory diseases may, in general, be regarded as quite visionary." Every obstetrician must have noted the absolutely unimpaired recovery of lying-in women in whom a moderate post-partum hemorrhage has occurred, and to the surgeon it is a matter of every day experience that in the large majority of surgical operations not complicated by previous shock, and unattended by excessive hemorrhage, a certain loss of blood in no wise hinders a satisfactory convalescence. In making such references I know that I lay myself open to the very evident contention, that such patients are, at the time the loss is sustained, in the full tide of health, but this is hardly so, for the blood of the pregnant woman,

although greater in bulk, presents those very characters which excessive hemorrhage develops—it is deficient in hæmatin, and it contains an excess of fibrin; while most surgical patients demanding for their relief severe operative measures cannot, as a rule, be held to have the fullest health. Moreover, it happens that in many cases of debilitating disease, hemorrhage, it may be as the effort of Nature, does occur, and its occurrence hinders neither the favorable progress of the malady, nor the convalescence from it. One such instance occurs to me now. A young gentleman, a patient of Dr. Walker, of Dalston, who has for many years been the subject of mitral disease with well-marked aortic regurgitation, and who for the past two years has had chronic Bright's disease, was at the end of last autumn seized with acute pleuro-pneumonia. A more unpromising case it would be difficult to find, for he had suddenly superadded to his burden of chronic and incurable disease, an acute inflammatory ailment, attended with high temperature, much dyspnœa, and very considerable physical suffering. Owing, in part, to the existence of renal disease, and doubtless, in part, to the presence of aortic insufficiency, he had on the night of my first visit a considerable epistaxis. That it had done him no harm Dr. Walker was confident, and my own feeling was that it had probably done him good. A recurrence happened some days later, and, although upon that occasion, owing to the absence of his doctor, he lost a good pint of blood, which, undoubtedly, *temporarily* debilitated him, he struggled through his pneumonia, and, what was even more satisfactory, he recovered after a single tapping from the empyema of which his pleural effusion was constituted. Had excessive dyspnœa demanded it, how few would have dared to bleed this man to twelve ounces, and yet events demonstrated that even such a loss was not incompatible with a satisfactory recovery.

It has been written by a great clinician that "men bear no mark that denotes their great or their small susceptibility to mercury," and this in a measure seems true of bloodletting also, for in the case of chronic disease I have related a very considerable hemorrhage made little apparent difference, whereas Dr. John Duncan tells me that an athletic student who, in perfect health, was bled for purposes of transfusion, was long in recovering from its effects. That idiosyncrasy should exist with reference to bloodletting, experience in the use of many other remedies would lead us to expect.

In considering the advisability of the employment of bloodletting, the primary questions which arise are these: Is the condition of the patient so urgent as to demand its aid, and is there a fair probability of the loss he will thus sustain being satisfactorily replaced? Wise and necessary as is this association of interests, and important as is its general maintenance, it is easy to understand how the importunity of the one may, at times, justly overrule the prudence of the other, for when life is in im-

minent jeopardy we must act for the present, cherishing the hope that the good to be attained may quite outdo the evil attendant upon the letting of blood. And this position is made still stronger when we call to remembrance the fact that in the very large majority of cases the loss of blood need not be great, for the effect we desire is an *immediate* one, one if at all attainable, produced very quickly, and, therefore, bloodletting by possessing this quality has that within itself which is adverse to the withdrawal of an inordinate amount. Thus is it that the aphorism of Sir Thomas Watson is readily compassed, "bleed so as to secure the advantages of the remedy and to avoid its disadvantages," and with a view to a demonstration of the value it certainly possesses, I will, in dealing with this question, relate some of the scattered lessons of my own limited experience.

When bloodletting was in the plenitude of its power there was no morbid condition in which it was employed more unhesitatingly than in apoplexy. The reasons for this are not difficult to seek, for, homœopathic as such treatment may be reckoned, there can be no reasonable doubt that in many cases of severe visceral hemorrhage, general bloodletting is alone able to control it. The temptation to make this knowledge the foundation for action was doubtless increased by the condition of the pulse generally associated with cerebral hemorrhage; for the feeling it conveys through its very fulness is that of its hurrying on in such a volume as is certain to increase extravasation and nerve destruction. Thus, I fancy, it was that bloodletting became the "summum remedium" in all cases of apoplexy, and, although we now know that in the very large majority of instances it is not only a powerless, but a dangerous remedy, there is one form of attack in which most physicians agree it may still be employed with possible benefit—that form is the ingravescent. Unhappily, the cases are rare in which opportunity offers for its use, for its earlier march, at times slow enough, it may be, to anticipate, is too frequently hastened by the attacks of vomiting which characterize it.

In the last two cases that have come under my observation this history was most notable, for with the access of vomiting there came such acuteness in the development of coma, that it quite outran any possible good derivable from bloodletting.

That in fitting cases—cases seen early in their progress—it may prove useful I shall endeavor on lines which are fairly parallel to show.

Experience gained by the surgeon is often of equal value to the physician, for, although the conditions which give rise to certain results differ, the results themselves are so akin that the danger pertaining to them has a common significance. Therefore it is that I quote the following case to show that in bloodletting we have a remedy of value in

"ingravescent apoplexy," albeit that apoplexy be external to, instead of within, the cerebral cortex.

M. B. was thrown with great force from the conveyance in which he was driving, and pitched upon his head. He had well-marked concussion, followed by decided reaction, with a full, but not too rapid pulse. Some hours after he was first seen he was attacked with severe headache, complained of a rushing noise in his ears, had some embarrassment in his breathing, was a little confused, had widely dilated pupils acting slowly to light, and his pulse had fallen from over 80 to 52 in the minute. He was at once bled to the extent of a pint, which relieved his headache, and his breathing, and under which his pulse rose to its old rate of 80 in the minute.

A few days after, having, contrary to all instruction, risen from his bed and made some exertion, the old symptoms reappeared, headache, dilated inactive pupils, and slow, laboring pulse. Venesection again, and with this great relief, and an ultimate satisfactory recovery.

It may fairly be argued that in this case I have no certain proof to offer that extravasation had occurred, and I am glad that such proof is wanting, but I have notes of another case in which, following a severe blow on the head, there were, on three separate occasions, attacks exactly similar to those observed in M. B., the last of which, unhappily, proved fatal, and in that instance a post-mortem examination demonstrated the presence of a large clot, part of which had been recently effused, but of which other portions had, undoubtedly, been in existence for some little time. I record it as a matter of regret, that this case was not treated by venesection. It seems then but a fair deduction that a remedy which can arrest hemorrhage occurring outside the brain, should have equal power to control leakage taking place in its substance.

The power for good possessed by bloodletting in morbid states of the cerebral circulation is not, however, confined to the arresting of hemorrhage. There are certain pathological conditions attended by convulsive phenomena over which it exercises a happy control. The rationale of this is readily found through a mechanical explanation, for the tightly packed, and the unyielding character of the cerebral case, renders any disturbance in its vascular system fraught with very decided danger. If the amount of blood circulating in it be of necessity an ever definite quantity—and this, I believe, has been fairly demonstrated—then it follows that disturbance, say of a spasmodic character, in the arterial system must be associated with a plethora on the venous side. By their researches, Kussmaul and Tenner proved that sudden cerebral anæmia may induce convulsion, and there is a strong probability that the "status epilepticus," when fully developed, depends upon a pronounced anæmia in certain cerebral areas. This was the contention of Sir J. C. Brown, and the basis upon which he founded his treatment of it by the use of nitrite of amyl. Before, however, this valuable remedy had

been used in this way, it had happened to me to find how completely this dangerous condition could be relieved by free venesection.

One case I well remember, where the fits recurred with such rapidity and regularity, and where the intervals were marked by so profound a state of coma, that the man's condition seemed well nigh hopeless. A big bleeding, for he was a strong, healthy man, at once arrested his fits and, I believe, saved his life. That it acted by relieving a stasis in the cerebral venous system, and thus permitted a readier transmission of blood through the smaller arteries and capillaries, is probable.

Trousseau draws attention, in one of his masterly lectures, to the fact that in certain cases of convulsive epilepsy we may have a state of tonic convulsions lasting for a long time, "two or three minutes, instead of three times the number of seconds, and death from asphyxia as a consequence." I once witnessed in a little girl, the subject, not of true epilepsy, but of most severe convulsions depending upon a functional cause, this very state established, and the happy issue that resulted from the abstraction by me of a few ounces of blood from the external jugular, was one of the early experiences of my professional life.

If the theory of Dr. Hughlings Jackson (*Brain*, April, 1886) be correct, that infantile convulsions depend largely for their development upon a venous condition of the blood circulating in the respiratory centre, then it is not difficult to understand how oft-repeated and long-continued spasm, interfering as it does with the respiratory act, should perpetuate the tumult, and how direct relief to the venous system may speedily arrest the convulsive disturbance.

Before proceeding to allude to those conditions in which the benefit attending bloodletting is conspicuous and undoubted, I would make mention of the advantage which attends its employment in certain cases of simple croup. I am not likely now ever to forget—for the early writings on the folds of memory are the most indelible—the relief which I, when a little lad, suffering from croup, obtained by venesection. Emetics, hot fomentations, and the warm bath, had all been employed, but with no benefit, the dreadful feeling of suffocation was still unrelieved, while following immediately the withdrawal of several ounces of blood from the arm I was easy and comfortable.

It would be a marvel, then, that if thus taught, it seemed the lesson of a *life* in its fullest sense, I should have denied the same relief to others, and thus it is that, in late childhood and early youth, when other means have failed, and when in vigorous adolescents, cynanche laryngea is marked by the symptoms noted by Cullen, "respiratio difficilis, inspiratio strephens, vox rauca, tussis clangosa," then my trust, and my expectation, lie in a moderate phlebotomy.

In the treatment of visceral inflammations bloodletting held for long the leading place, and although the virtues it was said to possess are by

many openly questioned to-day, there undoubtedly exist still certain conditions, the result of inflammatory hyperæmia, where its action is of signal benefit. That this should be so seems a natural inference when we recall the fact that in disturbed and perverted action of the vascular system, arise those changes which mark this morbid state, and that bloodletting exercises such power over the circulation as is unmistakable and undeniable. That the establishment of acute hyperæmia in the pulmonary area should exert a most pronounced effect on the whole vascular system, and that the action of bloodletting should, in this case, may be, best demonstrate its power is readily surmised.

The further fact, that the manifestation of this power is *immediate* renders it in such conditions as those to which reference will be made, of the very highest value. The little knowledge I have of its employment in pneumonia is in no wise sufficient to justify any expression of opinion as to its favorable effect upon the type, and the duration of inflammatory disease. All I wish to claim for it is its mechanical power of relieving suffering, of relieving blood-stasis, of restoring a lost balance between heart and arteries, and in this wise abating certain symptoms, the presence of which threaten very directly the life of the patient.

In pleurisy attended with grave inflammatory fever, with severe stitch, and with much difficulty in breathing, I have seen the most marked relief follow the practice of bloodletting. Now, however, that we possess in the hypodermatic injection of morphia so direct and so speedy a means of allaying pain, the temptation to use the lancet is not so great, for if there was *one* feature in the case which venesection did benefit, it was the intolerable suffering the patient was enduring.

I have a belief that the most dangerous forms of this disease are not those in which there is much effusion, rather are they marked by the exudation of lymph over a very wide area, and it was in the early days of such cases that venesection seemed to me to prove most beneficial.

Around the treatment of pneumonia has the dispute regarding the virtues and the evils of bloodletting raged most fiercely. This, to say the least of it, has been unfortunate, for, although there can be no doubt that indiscriminate bloodletting in pneumonia did an infinitude of harm, and ought, as a rule, to be entirely deprecated, there is still one form of the disease, and there are certain states which may arise in its ordinary course, in which to withhold its performance would be a grave error.

Let me, by the short narration of a case, illustrate the form of pneumonia in which, by its action, it may prove more than a mere alleviator.

A. H., a strong, muscular ploughman, had, by an unfortunate accident, the wheel of a heavily loaded cart "backed" across the right side of his

chest. Five at least of his ribs were fractured; he had considerable emphysema, some pneumothorax, and pretty profuse hæmoptysis. Thirty-six hours after the receipt of his injury he was found with all the symptoms of acute pneumonia. He had grave inflammatory fever, his temperature was high, his pulse hard and full, he had an incessant short cough, and much difficulty in his respiration. That this difficulty was in a measure brought about by the pain attending upon the increased respiratory efforts was very apparent.

It was impossible to examine satisfactorily the anterior part of the chest, but behind, he had over a wide area very decided dulness upon percussion, with harsh respiration. I bled him freely from the arm, with great and immediate relief. Within the next twenty-four hours his pulse and temperature fell quickly, and although his lung afforded evidence of more or less consolidation for some days after, it never, I believe, reached the stage of true hepatization.

That in this case bloodletting, by the power it exercised over the distribution of blood, carried relief to the pulmonary circulation, which, through the operation of various factors had become overcharged, and thus assuaged dangerous symptoms, is fairly certain.

Wide, and great, as the difference undoubtedly is between pneumonia following an injury, and the disease as we meet it in the ordinary way, and certain as is the tendency it often has, when appearing in this shape, to terminate life by asthenia, we may witness ever and again in its course such conditions as demand for their relief that promptitude in action which bloodletting alone can bring, and here again I will make use of a clinical note.

B. G., a healthy lad of twenty, was the subject of right-sided pneumonia. For the first five days of his illness matters went fairly well with him. He had a quick pulse, and a high temperature, but his respiration was not more rapid, or more distressing, than the pretty complete involvement of nearly his whole right lung readily explained.

On the sixth morning, however, the aspect had changed—he was struggling for breath, his face, his lips, and his tongue were livid, his pulse was quick and small, but *he had a strongly beating heart* and copious pneumonic expectoration. Examination of the back of his chest revealed the fact, that in addition to the harm in his right side, he had now fine crepitation over the left base, proving that both lungs were implicated. He was at once bled to ten ounces and with immediate relief. Stimulants and liquid nourishment were given him with a free hand, his poultices were continued, and he ultimately made an excellent recovery.

The explanation of the sudden gravity of this man's condition lay in the occurrence of over-distention of the right heart, the direct sequence of that further obstruction in the pulmonary circulation which the congestion of the left lung had brought about. The feebleness of his pulse at the wrist, proof of the small quantity of blood pouring into the left ventricle, and the violently acting heart excited by the presence of an unwonted amount of blood, and doing that which in it lay to overcome

an obstruction which threatened the extinction of its action, formed the best and the surest indication for the abstraction of blood. Vigorous as a heart may be, and capable in ordinary circumstances of contending for a time with stasis in the pulmonary circuit, there can be no doubt that in the pyrexia which marks the pneumonic process, we have that which, by favoring the occurrence of rapid dilatation, renders the struggle more doubtful, and the necessity for immediate action more imperative. For this reason it is that in extreme dyspnœa, and when there is evidence of a lost balance between the right and left heart, a remedy which like bloodletting is proximate in its action, is of the very highest value.

Prevalent as is pneumonia, and frequent as are the opportunities afforded to the practitioner for observation of its treatment, the occasions are very few, and very far between, in which bloodletting is demanded.

It is, however, otherwise with another disease of the lungs—acute pulmonary œdema—suffocative catarrh.

I am not aware that the essential pathology of this condition is fully determined. It is often so sudden and so swift in its onset, so evanescent in its existence, attended by so little constitutional disturbance, and withal so grave in its possible results, that it may well be a neurosis—vasomotor in its seat, and having for its characteristic feature the rapid outpouring of mucus into the smaller bronchi. It very usually arises from exposure to cold during the existence of a bronchial catarrh, and it is strongly predisposed to by the presence of disease of either the heart or kidney. In both these morbid states there doubtless exist such vascular conditions as influence gravely the mechanism of the pulmonary circulation, and dependent, mayhap, upon this fact rests the value of bloodletting in its treatment.

How great that may be, this case will best explain.

A gentleman, past middle life, consulted me some time ago on account of dyspnœa on exertion. He had been quite well until a few months before he visited me, when, without warning of any kind, he had an attack of pulmonary apoplexy which nearly proved fatal. His pulse struck me as hard and tense, and his heart-action as too forcible, although there was no very decided increase in the cardiac dulness. There was, however, a marked impurity and prolongation of the first sound at the apex, and a certain heaving action in this situation. The second sound at the base was markedly accentuated.

I examined his urine with care—it was of acid reaction, of good specific gravity (1.025), and was free from albumen.

I was puzzled, for I expected to find evidence of a granular kidney, and failing in this I fell back upon the hypothesis that he might possibly have slight mitral stenosis.

Uncertain on this point, and still believing that arterial tension was playing a part in the production of his symptoms, small doses of calomel were prescribed, and he was carefully dieted. From time to time he

called upon me, and his record was one of improvement. Then at midnight on the 16th of October I was sent for hurriedly, and found him extremely ill. He had caught cold a week before, and had had more or less cough. On the afternoon of his attack—a cold, raw day—he had driven many miles in an open carriage. Up to the time of his retiring to rest he made no complaint, but as sleep was about to overtake him, he was suddenly roused by a feeling of intense dyspnœa. Living as he does close by me, I was soon beside him. He was propped up in bed, and wheezing loudly; his face was flushed, his expression anxious, and while he breathed with great difficulty, he expectorated from time to time the reddish mucus characteristic of suffocative catarrh. His pulse of 80 was hard and laboring, but his heart's action was not perceptibly increased, either in rapidity or in force, and his chest, clear on percussion, was filled with mucous and submucous râles, with an entire absence of vesicular murmur. Short time as the attack had lasted his condition was too grave to be benefited by the use of expectorants, and I made preparation to give him a subcutaneous injection of apomorphia. The advance of the disease was more rapid than my action, and he quickly passed into that state of semi-consciousness when the action of emetics is neither so prompt nor so satisfactory.

Dr. Lockie, for whom I had sent, now joined me, and we happily agreed as to the employment of bloodletting; he however remarked, and I quote his words to mark the gravity of the case, "bleed him or not he will die." He was now more or less unconscious, he was livid in color, and his heart, quickening in action, was unquestionably failing in power.

The opening of a vein in the left arm, performed in the usual way, proved futile, for the blood was so thick and tarry that it would not flow from it; so dissecting down upon the right median basilic, and exposing its surface clearly, I made into it a long and free incision. By constant pressure and friction the stream began, slow at first, and then more full, and when a pint of blood had escaped he expressed himself as "beginning to be relieved." Another pint was taken, and as the arm was being bound up, he said, "I am quite well; I could rise and walk." Within thirty-six hours, and without the occurrence of much expectoration, all râles had disappeared from his chest, and he was in his usual health. Since then he has had another similar attack, not attended, however, with quite such peril, for he was seen early, and he was bled to twelve ounces. The relief obtained upon this occasion was as striking as it was upon the previous one.

Now, his case is clear, there is a trace of albumen in the urine, there are to be found a few granular casts, and he presents unmistakable evidence of considerable arterial tension.

In cases such as this, where the advance of disease outstrips the action of all ordinary remedies, the immediate effect of bloodletting touches the miraculous.

To the good it can accomplish in cases of mitral stenosis, when, under certain circumstances, the chronic condition of distention of the right ventricle, always more or less in existence, becomes suddenly aggravated, I can bear no personal testimony; but the want of it is of small moment when I can refer for confirmation to the writings of Broadbent, of Chambers, and of many other able physicians.

Here, however, I would add an interrogatory note.

It is well known how much Dr. Angus Macdonald ("Heart Disease during Pregnancy") did to bring into recognition the peculiar dangers attendant upon cardiac disease in childbearing women, and how valuable are his records of the unfortunate progress of some of these cases. In one such, not however under my own care, in which mitral disease and pulmonary œdema brought about a condition of extreme gravity during labor, venesection proved of the greatest benefit, and I have a belief that I have seen relief to the struggling action of the diseased heart brought about by the increased tension accompanying delivery, follow the occurrence of a somewhat free post-partum hemorrhage. It is quite possible, then, that venesection might relieve the serious symptoms which, in such circumstances, at times *immediately* follow delivery.

Among the new phrases which mark the advance of the science of medicine there is none better known than that of "arterial tension," yet some accept its existence with reservation, and incline to believe, that as its presence is not easily refuted, and is often more a matter of opinion than demonstration, it is a *modern* term apt to be used with too convenient a looseness. It seems to me, however, that in the recognition of that hard, incompressible character of the pulse, which formerly led so often to the practice of venesection, lies the demonstration, that although lacking that full knowledge of the dangers which, to us, this condition portends, arterial tension has long been regarded by the profession as one of the states which bloodletting can successfully combat. And so it remains, for, spite of the teaching of Foster, that moderate bloodletting does not reduce blood-pressure, there is ample clinical evidence to show that it possesses the power of relieving those urgent symptoms which are the direct issue of acute increase in vascular tension.

High arterial tension is most familiar to us in connection with renal disease, and some of the most formidable states which arise in its course have probably a very close connection with its existence.

The pulse in some cases of acute Bright's, and in granular disease of the kidney generally, has very special characteristics, and when, as time runs and under the retarding action of the muscular arterioles pressure in the arteries rises high, its cord-like feeling in unmistakable. Then it is, I believe, that convulsive phenomena are most apt to make their appearance, and in certain cases imperatively demand for their relief the employment of general bloodletting.

How valuable this may prove, the following case, the last of its kind which has come under my observation, and belonging to a group well known to most practitioners, albeit the subjects are generally of more tender years, will show.

Some little time ago I saw with a practitioner in a neighboring county, a gentleman suffering from scarlatinal nephritis. He had been ill for

three days when I was asked to visit him, and he had been treated in the most judicious way. He had been purged, had hot air baths, had pilocarpine injections, and such a diet as was best suited for him. Still he did not improve, his urine was exceedingly scanty and highly albuminous and a complaint of some dimness in vision made his attendant anxious about him. At the time we entered his room together he was in a violent convulsion, a foreboding of which occurred about an hour previously when he became suddenly quite blind. When the violence of the seizure had passed he was deeply unconscious, pale in the face, with a small pulse at the wrist, hard, however, and unyielding as whipcord, and with a forcibly acting heart, of which the sounds, both at base and apex were highly accentuated. With the acquiescence of his doctor I bled him freely from the arm, and with such benefit that in a little while he became conscious and made complaint of headache. Two hours after we left him he had another but much milder fit, in the struggles of which the retaining bandage on the arm became undone and he sustained a further loss of blood. This, however, did him no harm, for when his attendant, sent for hurriedly to visit him, arrived, he found him fully conscious and free from discomfort. This condition happily proved permanent, there was no recurrence of the convulsion, and he made, thanks largely to the bloodletting, an unusually rapid and satisfactory recovery.

A case of renal disease such as this, is typically the one in which bloodletting may be employed without hesitation. The condition which has led to the production of the convulsion is acute in character, it has been but a short time in existence, there is no preëxisting impoverishment of the blood, and nothing of that deep undermining of the strength which marks the chronic Bright's. Apart altogether from the unmistakable relief to the convulsive disturbance which venesection in such circumstances usually brings, there is the further possible good it confers upon the general state of the patient. It is not often that now we treat inflammation as such by the abstraction of blood, and yet I venture to believe that in acute nephritis, occurring in a robust and healthy subject, there is no line of primary treatment more likely to prove beneficial than venesection. My reasons for thinking this are twofold: one the knowledge that in some instances death has been the direct and rapid result of such cardiac harm as is brought about by the sudden occurrence of acute arterial tension; and the other, the observation, frequently repeated, of the immense benefit which has followed the occurrence of a smart attack of hæmaturia. There is probably no organ in the body in which vascular pressure is so consistently high as in the kidney, and none in which bloodletting has more decided effect, as witness the benefit which follows its practice in certain cases of severe renal hemorrhage.

In dealing with convulsions in cases of chronic diseases of the kidney in some of which it is of striking value, we require to be more guarded in its employment. Here two points are worth remembering. The one, especially applicable to such cases, is the dictum of Graves in connection with bleeding, that "you may rely on it that every ounce of healthy

blood you take away is shortly replaced by two ounces very inferior in quality," and the other, that an impoverished condition of the blood is a factor in the production of uræmic convulsion, and that bloodletting by producing this state may predispose to future attacks. In some patients, however, enfeebled beyond all doubt, in whom convulsions have their origin in local cerebral œdema, its occurrence marked, it may be, in addition by the presence of hemiplegia, a small bleeding of one ounce or two may prove of the greatest benefit. It is no doubt difficult in some instances to diagnosticate the morbidness which underlies the state of the patient from that of cerebral hemorrhage, but where convulsions are recurring, and the temperature is subnormal, it is wisest to let blood.

In very intimate—in almost inseparable—relation with the convulsions to which I have referred, are those observed in the pregnant and parturient woman. It has sometimes occurred to me that the bond of relationship which binds them most closely to one another, is that of high arterial tension. I have witnessed most severe eclampsia in a case in which there was comparatively little albuminuria, and if we estimate —and I believe that in such cases it is a pretty reliable guide—the extent of damage to the kidney by the amount of albumen thrown down, then we must look for something besides the renal mischief to account for the production of convulsions.

This, I take it, will be found in that normally existing state of pronounced arterial tension which is the constant accompaniment of gestation. The presence of cardiac hypertrophy, increase in renal pressure, increase in the quantity of blood, and probable increase, as mooted by Barnes, in nervous force, all contribute to the production of increase in vascular pressure, and when, superadded to these many separate factors, we have nephritis—probably degenerative in its nature—bringing as its results not only a further and harmful increase in the quantity of blood in the vessels, but most marked deterioration in its quality, then it is readily understood how a minor degree of renal mischief may determine the occurrence of eclampsia.

The best known theories regarding the causation of puerperal convulsions have for their basis this excess in arterial tension, and therefore it might seem *à priori* that in such cases bloodletting would prove useful. And so it does in some, for although in the majority the use of chloroform, chloral, or pilocarpine, remedies possessing the power directly or indirectly of lowering vascular tension, may be found sufficient, there yet exists a minority of cases, in which the form and the gravity of the seizure demand for its safest treatment recourse to venesection.

Marked severity of attack, with extreme congestion of the face, and turgidity of the vessels, as its characteristics; and profound coma, with flushed face, and a hard, long pulse, in the intervals of the seizures, form, maybe, the most reliable guides for such treatment. I well re-

member one such case, a primipara seized within an hour of her delivery with convulsions of such frightful severity as to render their remembrance with me indelible, and how, after chloroform had been used without avail, a free venesection altered at once the whole aspect of her condition. I am happy in this experience, that although all the cases I have seen were not treated by bloodletting, those which were, and these the most severe, made excellent recoveries, and whether due to the fact that such treatment tended to the more speedy cure of the kidney disease, or that they lacked a vital tendency to its development, they all escaped what unhappily came to some of the others, recurrent puerperal nephritis, with its sad tale of disaster.

The importance attaching to the condition of high arterial tension becomes increased by the knowledge of the fact that it may exist independently of disease of the kidney, and that it may prove the cause of such convulsive phenomena as are indistinguishable in their characters from those that mark uræmia. That this depends upon the peculiarities of the cerebral circulation is most probable. It is not easy, as Broadbent has pointed out,[1] to say how convulsions are produced, but if we admit that acute increase in vascular tension has a possible power of causing anæmia of the brain with, perchance for its sequence, a serous effusion in the meninges, and that it may give rise to the occurrence of capillary hemorrhage in its substance, then we can understand how capable it may prove of producing such nerve storms as betoken the occurrence of some hitch in the circulatory balance of the great seat of nervous force. The harm to which it gives rise is, however, not always so startlingly evident, but it is none the less grave; cardiac disease, aneurism, arterial degeneration, these all follow in its train, and render it one of the conditions in which a ready recognition and a fitting treatment must go hand in hand. It has happened to me on several occasions to observe in elderly men, the subjects of gout, how much relief has been brought to somewhat indefinite but most troublesome symptoms by a smart epistaxis.

Last autumn I had under my care a gentleman of sixty, of well-marked gouty tendency, suffering from headache, giddiness, and extreme irritability of temper. He had all the physical signs of high arterial tension, but without evidence of any organic disease. He was treated by calomel and salines as active purgatives, and he was carefully dieted, but with little improvement, until the occurrence of a severe epistaxis brought him entire relief. Then I recognized fully how certainly a moderate bloodletting would have saved him suffering, and myself anxiety concerning him.

His was one of the cases in which there is no existing disease of the

[1] Lancet, 1883, vol. i. p. 4 et seq.

kidney, but in which a gouty condition of the blood, coupled maybe with a plethora, led to increase in arterial tension, and, as sometimes happens, to apoplexy as an unhappy sequel.

The term of gestation is not the only period in a woman's life when she may become the subject of high arterial tension. It may come to her in the earlier years which succeed the establishment of menstruation, through continued amenorrhœa, and it may, and very frequently does, during the epoch of the climacteric. Many of the very trying subjective symptoms of which bitter complaint is made at this especial time have their origin in vascular disturbance, and I have noted in some cases how relief to them most certainly followed the action of such remedies as render the pulse softer and more full. But its ill effects may be so pronounced as to endanger life. Here is an instance, the most pronounced I have ever seen, but fraught with instruction:

In the early hours of a morning in last June I received a note from Dr. Graham, of Kirklinton, asking me to see with him a patient who was thought to have had an apoplectic attack. She was a farmer's wife of forty-five, stout, red-faced, and plethoric. For nearly four months the catamenia, normally large in amount, had disappeared, and latterly she had been short-winded and her respiration very easily distressed. Her doctor had seen her on several occasions, because she had general malaise and headache, but there seemed nothing in her state to provoke anxiety. On the evening preceding my visit he had called, and found her much in her usual state, except that a slight menstrual discharge had made its appearance. At midnight she was discovered to be in a condition of profound coma, and in this state Dr. Graham found her. When we met at her bedside she was better, for she could be roused sufficiently to answer questions, but she was stupid and uncollected. The face was flushed and somewhat congested, her pupils dilated and inactive, her heart slow and heaving in its action, with a *clanging* accentuation of the second sound at the base, and her pulse was hard, full, long, and incompressible. There was a little discharge from the vagina and some urine drawn from the bladder contained a trace of albumen. The albuminuria rendered the diagnosis uncertain, but as the acuteness in arterial tension was unmistakable, we bled her freely from the arm. Nearly thirty ounces were taken and this without faltering of the pulse, and, indeed, before it became large and soft. Then she became fully conscious and made complaint of a little nausea. As her bowels were confined, a brisk saline purge was prescribed and a restricted diet. Next day, her doctor, long detained by matters obstetric, went with some anxiety to visit her. He found her downstairs presiding at the tea-table, perfectly hearty and well. Despite the facts that her appearance and her history negatived the existence of granular kidney, the presence of albumen in the urine rendered me at first suspicious, but it never could be detected at any subsequent examination, and when, a week or two ago, I made inquiry regarding her, I found her in perfect health.

That the albuminuria and the slight uterine discharge had a common origin in the high arterial tension, and that the state of coma in which

she was found followed an unrecognized convulsion are sequences I think very probable. In the existence of acute vascular pressure lay the primary harm, and this harm bloodletting relieved in a manner with which no other remedy could cope. This relief was as evident and striking to those standing around as it was to the medical attendants.

That in cases depending upon menstrual irregularity the excess in tension arises from simple increase in the volume of the circulating fluid is, I think, likely; and hence, in some of them, as happened in the instance just related, bloodletting not only brings relief to urgent symptoms, but it effects a permanent cure.

Here may well end my quest. It is not without due deliberation that I have recorded these views with reference to the value of bloodletting, for, although there has been, of late, a decided reaction in its favor, there still exists a strong prejudice against it, and where many of the wisest and best hold opposite opinions it seems immodest to speak with decisive tone. And yet it is not necessary when we speak with decision to speak presumptuously. The opinions that are mine on this matter have grown slowly, and they, at least, have this possible merit, that as the result of experience and of thought they have become convictions. To some the premises upon which they are based may seem quite inadequate, and the views wrong, but I have, nevertheless, ventured to narrate them, because they are my firm beliefs, faith in which has stood the strong touchstone of practice.

It was a proposition of that wise physician, the late Dr. Peter M. Latham, that the groundwork of rational practice is to understand the value of single indications, and the power of single remedies; and as there seems to be no treatment for which the indications are so decisive —none in which a single one may more surely point the way than for bloodletting—and no single remedy which, in necessary circumstances, possesses so great a power, I will finish, and at the same time point the object of my paper, by a quotation from his writings: "I am persuaded," he says, "that when the physician is called upon to perform great things, even to arrest destructive disease and to save life, his skill in wielding the implements of his art rests mainly upon the right understanding of simple and single indications, and of the remedies which have power to fulfil them."

CARLISLE.

# PRECOCIOUS GUMMATA.[1]

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The close and widespread study of syphilis within the past fifteen years has conclusively shown that the old and dogmatic division of the disease into three sharply marked periods must soon be very much modified, or perhaps even discarded, and that, although the terms primary, secondary, and tertiary, as applied to stages of syphilis, present the advantage of clearness and simplicity in study and description, and may even be clinically true as regards a large number of cases, yet there are very many in which such a division is inappropriate, since we observe in some the so-called tertiary lesions in the secondary period; in others seemingly secondary lesions in the tertiary period, and perhaps coexisting with well-marked lesions of that period; or, again, cases of tertiary lesions concomitant with secondary lesions. To hold, then, that superficial lesions belong to and are only found in the early or secondary period, and that they are followed later on by lesions involving the tissues more profoundly, is in reality to sacrifice facts for simplicity of description. Indeed, one of the as yet unsettled problems of great importance in syphilology is that relating to its periods, classification, and chronology.

One of the main facts which militate against the old division is that which has been so prominently brought forward of late years, namely, that there are many lesions and affections which were formerly looked upon as belonging to the tertiary period, which are very frequently observed to assume a precocious development, appearing more or less early in the secondary period. Thus we not infrequently see within the first year of syphilis destructive ulcerations of various size and depth which we call malignant, precocious syphilides. Not infrequently do we meet with cases of osseous and articular lesions which, under the old division, we can only term precocious since they appear in the so-called secondary stage. Marked instances of early gummatous development are seen plainly in the gumma of the iris, and again severe infiltrations of the pharynx and larynx are not infrequently observed early in the first year of the disease. Then, again, observations made within the last decade have shown that affections of the nervous system, which at one time was thought to be spared by the syphilitic virus, and in later times attacked only in its tertiary stage, may develop within the first six months of syphilitic infection. In considering this subject of the rela-

[1] Read before the American Dermatological Association August 25, 1886.

tionship of secondary to tertiary lesions, that eminent surgeon, Mr. Jonathan Hutchinson,[1] says:

"What has been named a 'gumma' has been supposed to be characteristic of the tertiary stage. Opinions have, however, been changing respecting several, if not all, of these points. Cases have been recognized in which the various conditions referred to were met with so early in the disease, and in such close combinations with each other, that the only explanation seemed to be that the disease had run an unusually rapid course, and had reached its last stage before it had well finished its first. By degrees we are, however, arriving at another interpretation of such facts, and are beginning to see that the old classifications of the phenomena cannot hold their ground, and that we must seek for other characters by which to distinguish the secondary and tertiary stages. Not, indeed, that the old observations are wholly wrong; this would be exceedingly improbable, and its mere assertion would very properly lead to much distrust of any modern conclusion which might seek to supplant them. Speaking loosely, and in a general way, it is still true that visceral affections, gummata, deep ulceration and periostitis belong to the tertiary stage. It is only when these facts are brought forward as if they were constant and sufficient in themselves to form the basis of classification, that we are compelled to make protest."

He then continues:

"Permit me to illustrate what I mean by the citation of a case. A young man, aged twenty-one, too young, let me note, for it to be likely that he ever had syphilis before, was admitted into the London Hospital under my colleague, Dr. Langdon Down. He had still the remains of a hard chancre on him, and he was covered by a papular rash, which was ulcerating in places. The date which he assigned to the beginning of the affection was only four months previously. He died suddenly and unexpectedly. The necropsy showed gummata in both testicles, in the spleen, and in the heart, death having been caused by the softening and ulceration of the latter."

Though Mr. Hutchinson thus shows the shortcomings of the old classification of syphilis, he does not attempt to establish a new one. In this he is, in my judgment, wise, seeing that in our knowledge of the natural history of syphilis there are yet many lacunæ, notably in that of early visceral lesions. In Germany, also, the insufficiencies of the old classification have been treated of in an excellent article by Finger,[2] who, however, has no new one to offer.

Though to-day there are comprehensive descriptions of precocious nervous, osseous, articular, ocular, and superficial ulcerative dermal affections due to syphilis, a systematic description of the clinical history of precocious gummata is wanting.

It must, in justice, here be stated that our knowledge of many of the precocious affections of syphilis is in a large measure due to the writings of that eminent syphilographer, C. Mauriac. His paper, entitled "Cas de syphilis gommeuse précoce et refractaire à iodure de potassium," Paris, 1874, is, according to my reading, the first contribution to the

[1] Lettsomian Lectures on Some Moot-Points in the Natural History of Syphilis. British Medical Journal, January 23, 1886.

[2] Ueber die Koexistenz der sogenanten secundären und tertiären Syphilisformen. Wien. med. Wochenschrift, Nos 1 and 3, 1882.

subject of precocious gummata, and this, with his latter paper, "Memoire sur les affections précoce du tissue cellulaire subcutanée,"[1] constitutes up to this time the literature of this form of eruption.

In the present essay the divisions and clinical descriptions are based wholly on my own observation and study during a period of many years, aided at times by the facts observed by Mauriac. In many points my experience accords with that of this painstaking observer, while in others it is more or less at variance.

I propose to present the clinical histories of a selected number of my cases, from which I think I can trace a clear and satisfactory description of these not common nor yet infrequent eruptions.

My studies have convinced me that there are three forms of the precocious gummata: The first, the generalized form; the second, the localized form; and the third, the neurotic form, which in some of its features resembles erythema nodosum. Of each of these three forms, moreover, there are two varieties: a resolutive, or non-ulcerative, and an ulcerative variety.

## I. The Generalized Form of Precocious Gummata.

A clear idea of this form of syphilide is presented by the following case:

Case I.—A merchant, aged thirty-six, came under my observation in May, 1885. He was a tall, thin man, of exceedingly nervous temperament, never very strong, who continually overtaxed himself mentally and physically, and subordinated to business every pleasure and relaxation. Excepting several attacks of gonorrhœa, and more or less prolonged periods of extreme debility, he had had no real sickness in his life. He came of excellent stock. In January, 1885, he had a large indurated chancre, with marked inguinal adenopathy, which was followed late in February by a roseola and papular syphilide, fall of hair, rheumatoid pains, emaciation, and asthenia. For these he had been treated by an out-of-town physician in a proper manner.

Late in May, three months after the evolution of the secondary period of syphilis, he came to me, at the advice of his physician, presenting the following symptoms. On the scalp a tendency to loss of hair, mucous patches in pharynx, and over the body a declining papular syphilide, interspersed with slight maculations of what had been a deep-tinted roseola. Amid these retrogressing lesions was the eruption which is of interest in this paper. Over the nucha and the shoulders, on the outer aspect of the arms, particularly over the elbow, over the gluteal region, quite copiously on the outer and anterior part of the thighs and legs, and sparsely on the inner aspect of these members was scattered an eruption of tubercles, varying in size from a lima bean to a walnut, which numbered by actual count more than forty. These tumors were seated firmly in the skin, involving its whole thickness, besides some of its

[1] Annales de Dermatologie et de Syphiligraphie, 1880 and 1881, and Leçons sur les Maladies Vénériennes, Paris, 1883

underlying connective tissue, were easily movable, and sharply circumscribed. They were of a dull red color, some of them level with the plane of the skin, while others, and particularly the larger ones, were in a moderate degree salient. They were in general covered with normal epithelium.

Amid these well-developed tumors were fully fifteen very minute ones, of which several could not be seen by the naked eye, but on searching for them presented to the tip of the finger a feeling of movable, circumscribed infiltration in the deeper portion of the derma. Others of these incipient tubercles, being like those just described, of the size of a pea, showed, upon examination, that they were infiltrations which had begun coincidently in the skin and connective tissue, while it was evident that in the former the morbid process began in the superficial layers of the connective tissue, and that they gradually contracted adhesions with and invaded the whole derma. The only further point of interest of this case in this connection, is that a few of the larger and older tubercles underwent slight and superficial ulceration, while the majority were cured by local and constitutional treatment within a month.

The period of time occupied by the evolution of the eruption up to the date of my first examination was, as nearly as could be determined, two weeks. During the whole course of the eruption the subjective symptoms had been very slight and were limited to a feeling of slight uneasiness and impediment to locomotion.

I may here add that the question in the mind of the attending physician, who was a very intelligent man, I only seeing the case at varying intervals in consultation, was, whether the eruption I have just described was really of syphilitic origin, or whether it was a coincident furunculosis of low grade and of aborted form. He very pertinently remarked that it seemed strange that such superficial lesions as roseola, papules, etc., should be followed so quickly by lesions so deep-seated as were these gummatous infiltrations.

The foregoing case may be taken as typical of the first, earliest, and most common form of the precocious gummata. It will be noted that while in its general and symmetrical distribution the eruption presented the features of the early and, we may perhaps say, exanthematic syphilides in the intensity and profundity of the morbid process, it partakes of the character of the late or tertiary lesions. In my experience this particular form of eruption, while not rare, is not very common. I usually see four or five of such cases every year in hospital and two or three in private practice.

These cases present considerable uniformity, and although to the experienced physician they usually offer no difficulty of diagnosis, I have often seen them prove stumbling blocks to the younger men and sometimes even to older ones.

This eruption may appear as early as the second month, and in the third, fourth, and sixth. I have observed that the earlier the date of

the appearance in general the more extensive is the eruption and the more numerous the gummatous tumors, and that while it is the rule to see many of them, thirty, forty, or even sixty or seventy, cases will be observed when as small a number as fifteen or twenty tumors are present. Not infrequently do we see the evolution of the eruption following or even coincidently with the existence of a general roseolous, a papular, or even pustular syphilide. It is not uncommon to find coincident gummy infiltration into the pharyngeal walls or into the mucous membrane of the roof of the mouth, or even less intense lesions of these parts. Serous and gummous iritis, neuralgic phenomena, even such grave affections as hemiplegia, paraplegia, and minor palsies may also be observed to be coincident with or follow closely upon the evolution of this eruption. Many observations which I have made have convinced me that in most cases there is an accompanying well-marked febrile movement just preceding and during the outbreak. In some of the milder cases the temperature may be elevated from one to two degrees, while in others, particularly in those of extensive eruption, the thermometer registers in the evening 102° or 103° F., with a decline of two or more degrees in the morning. Then, again, the fever may be slight and continuous, while in cases attended with much cachexia, a continuous high fever is occasionally observed.

This form of gummatous eruption attacks both males and females in about equal numbers; my own observations tend to convince me that some condition of lowered vitality or impaired nutrition is at the root of it and of other forms of early gummata. Thus I have met with it in persons of naturally poor fibre, in those of studious and sedentary habits, in persons exhausted by the cares and confinements of business, and last, but foremost, in those who are habituated to the excessive use of alcoholics. If the question was put to me, "In whom do you most frequently observe severe and precocious syphilides?" I should answer promptly, first, in those whose nutrition is impaired by alcohol; second, in those who suffer from renal and hepatic diseases; and, third, in those having these visceral lesions and, besides, who have been addicted to alcoholics. I am not as much impressed as some observers are as to the malignancy of syphilis in strumous subjects. Very many such patients become sorely afflicted by syphilis, yet in many that disease runs its course unattended by severe precocious lesions or even with late lesions of much severity. I have reached the conclusion from extended observation that in the so-called scrofulous person, provided his or her habits of life are good, there is not an unvarying tendency to malignant precocious syphilis. It is true, I have seen early and malignant forms of syphilis in strumous persons, but not in such numbers as to warrant me in placing struma in the front rank of its causes.

This form of eruption is found in both old and young, though my sta-

tistics show that the greater number of my patients were between twenty and thirty-five and after fifty years. My opinion is in accord with most syphilographers that syphilis in persons beyond fifty years of age is frequently severe; that its lesions are often precocious, grave, and extensive; and that the diathesis has a tendency to modify, to engraft itself upon and often to intensify previous morbid processes or affections, local or general. I have repeatedly seen instances of this malignant action, and I have very frequently seen the form of precocious syphilide now under consideration in old subjects.

Malaria very frequently acts as a formidable complication of syphilis, and some of the most rebellious cases that I have treated were in persons whose systems, prior to syphilitic infection, had been debilitated by its virus. In such cases I think that we more frequently see precocious cerebral and nervous symptoms, and not infrequently early hepatic disturbances, of greater or less severity. In these cases of mixed diatheses, however, the syphilides often run an active and severe course, and precocious gummata not infrequently attack them.

The clinical history of this form of precocious syphilide then is as follows: As early as the eighth week of infection, rarely earlier, the patient notices either small circumscribed swellings under the skin, generally unattended with pain and only perceptible to the touch, or this stage of the eruption may escape him and his attention is at first arrested by a number of bright red spots. Quite frequently the patient comes with the statement that blind boils are breaking out all over him. Examined early in their history these gummata are found to be round tumors of the size of a bean, deeply set in the skin, having a bright red color which, at the first, is dissipated by pressure, but becoming deeper, more sombre and permanent in color later on. They increase peripherally quite rapidly, so that within a week or ten days they may attain an area of an inch, or an inch and a half. Then again their growth may be slower. In general a goodly number of tumors appear scattered symmetrically over the whole body. As they grow they are followed by new ones which come along with greater or less rapidity, in proportion as internal medication is pushed. If a correct diagnosis is at once made and appropriate treatment instituted, the first crop may be the only one and that may be promptly dissipated. Unaffected by medicine, their evolution continues and in a fortnight the arms, forearms, perhaps the scapular region, not infrequently, but not as a rule, the back and anterior surface of the trunk, the gluteal regions, thighs, and legs are invaded by these tumors.

The course of these gummata is, in general, quite regular and not subject to great variation. When developed they present a quite firm sensation and this may be termed the period of condensation. As they grow older the red color becomes rather coppery, and while the periphery

of the tumor may or may not seem firm, the central portions appear softer to the touch, conveying the impression that the tissues are permeated with a thick fluid. This we may denominate the stage of softening, and is found to be of varying degrees in different cases. In some instances there is simply a soft and yielding sensation conveyed to the finger tip, while in others a feeling of slight fluctuation is noticed. To the inexperienced in the latter case these tumors may give the impression of being abscesses and suggest the use of the knife. But such a procedure should not be resorted to, since resolution may take place under the influence of treatment, even when the condition of softening is well marked. In the majority of the cases there is not abscess formation, but rather a liquefaction of the gummy infiltration, which is in general promptly absorbed. In the non-ulcerating or resolutive variety of precocious gummata, which we are now considering, the further progress of the tumors is as follows: They gradually become flatter, the borders melt away slowly, and the color *pari passu* fades until the normal hue or a coppery pigmentation of the skin is reached, which occurs soonest on the trunk and upper extremities and latest on the legs. On the latter situation the stage of softening may continue until the stage of ulceration sets in. Here, also, these tumors frequently take on inflammatory action when complicated with varicose veins, with œdema and chronic eczema and erysipelas. The time occupied in the full development of these tumors is usually from ten days to two weeks, and after that their period of duration is variable. They may, under treatment and care, promptly retrogress, and again may remain in an indolent condition in the second stage indefinitely. The traces left by them are generally very slight and not permanent, being simply slight hyperæmia and scaling and coppery pigmentation. Then again, in long-standing resolutive cases, after absorption has taken place distinct loss of tissue may be noticed in a depressed cicatrix, which, however, is not as profound as those left by the gummata of later periods. Not uncommonly, new and sparse crops of tumors appear while the general eruption is in process of absorption.

Having thus quite fully described the non-ulcerative or resolutive form of this very precocious gummatous eruption, a few words will suffice to bring out the features of the ulcerative variety. While in the first variety there is usually little or no tendency in the tumors to necrobiotic action, in the second variety this condition is seen quite early. The stage of condensation is very short, and softening in a marked degree is observed in a few days. The centre of the tumors assumes a dark red color in one or in several spots, and a sensation of fluid under the epidermis is distinctly made out. Then slight ulceration may occur in spots, often at the openings of the hair and sebaceous follicles, and very soon the epidermal roof of the tumor melts away, and we soon see

the gummatous ulcer with its slightly thickened, reddened, undermined, and perhaps everted edges, and its floor of a greenish-red, bathed in an unhealthy sanious pus. As a rule, however, these ulcers are more superficial than the later ones. Their floor is less deep, the edges less undermined and everted, and the whole appearance indicates that the destruction is less profound. I have seen instances of this variety in which as many as forty tumors underwent degeneration.

Having reached the stage of ulceration, the further course is indefinite, and it depends entirely upon the treatment, external and internal, which is adopted. The concomitant symptoms of this variety of the gummous syphilide are in general like those of the resolutive variety, only that they are usually more intense and accentuated. The fever is higher, the malaise more pronounced, and the general condition of the patient rather worse.

Usually there is no difficulty of diagnosis of this variety of precocious gummata. The infection is so recent that a history of syphilis is easily obtained and then all doubt as to the nature of the tumors is removed. I have seen them, however, mistaken for aborted furuncles and regarded as rheumatic tumors, as scrofulous swellings, and in a case in which the initial lesion was seated on the index finger and was accompanied by severe constitutional symptoms and an active angio-leucitis of the arm, they were thought to be the result of purulent infection.

### II. The Localized Form.

The second variety of precocious gummata usually appears somewhat later than the one just described. In exceptional cases I have seen the eruption as early as the third month of syphilis, though my notes show that in the greater number of cases the date of appearance was the fifth, sixth, or eighth month of infection and even as late as one year. Like the first variety, the evolution of these tumors is aphlegmasic, rather more insidious and indolent than that of the first variety, and, in short, partaking of their characteristics to a certain extent and, also, of those of the gummata of the tertiary period.

In the second variety, also, we find some cases in which resolution takes place, while in others the stage of softening goes on to ulceration. While in the first variety the tumors are smaller, more numerous, and more copiously and symmetrically distributed, in the second they are, as a rule, larger, less numerous, and, though generally symmetrically placed, occasionally they are unsymmetrical, existing upon one region and absent on its fellow of the opposite side.

As a rule, they are met with in the same class of persons as the first variety is, namely, in the aged, and those given to excess in alcoholics, in persons of strumous tendency, in subjects debilitated by any exhausting cause or adynamic influence, such, for instance, as visceral disease,

fevers, pneumonia, diphtheria, etc., and in those reduced by chronic malaria. Then, again, I have seen this eruption in patients who could not be classed in any of these categories, who had never had any sickness—yet, as they remarked, had never been strong; in short, persons of poor fibre. While there may be a slight prodromal or accompanying fever, it is usually absent, and the patients may not complain of any unusual intensification of their morbid condition.

The following case will answer well as a prototype of this second form of precocious syphilide in its full development; while very brief notes of other cases will be of service in showing its more restricted and less symmetrical distribution.

Case II.—A female, aged twenty-four, a blonde, fat and flabby, came under my observation at Charity Hospital in October, 1883. She had been in the hospital at different times for gonorrhœa and chancroids, was a woman of the town, and addicted to drink and dissipation. In April, 1883, she had an insignificant ulcer at the fourchette, which was followed by inguinal adenopathy, fall of hair, a severe attack of mucous patches of mouth, throat, and larynx, and a disseminated and very copious papulo-pustular syphilide. She was treated at a dispensary, but was negligent in following advice, and generally careless of her health. In September, five months after infection, she presented evidence over the whole body of a small miliary papular syphilide.

She entered the hospital on account of a number of tumors on her legs which began to appear about a week before. At the examination I found, on the outer aspect of the forearms, over both gluteal regions, and on the lower half of the leg, a number of tumors. These were oval in shape, following the longitudinal axis of the limbs, but obliquely transverse at the gluteal regions, slightly elevated, and were felt to involve the whole thickness of the skin, and part of its subcutaneous tissue. Their color was a pronounced red, tending toward brown; they were covered with a tolerably perfect epidermis, and surrounded on the legs by a bright red areola. Elsewhere the deep red color of the tumors stopped sharply at their borders. The largest of them, which were on the outer side of the legs, were about two and a half inches in length, by one and a half in breadth, while the others varied in size until the smallest were reached, which were less than an inch long. In all there were about fourteen. The woman's stomach was so much deranged, and her health so debilitated, that mercury in any form, or by any method of administration, was temporarily out of the question. The treatment was, therefore, directed to improvement of the appetite, and invigoration of the system.

While under this course, several subcutaneous tumors developed quite quickly, say within ten days, on the outer aspects of both the forearms and the legs. They could be distinctly felt at first as localized, sharply limited infiltrations, without any subjective symptoms whatever. In this condition they were followed carefully from day to day, when in two weeks they had attained an area of an inch and a half by one inch, having in the meantime fused themselves with the skin lying above them, and come to present features essentially like those of their predecessors. The patient presented very slight febrile symptoms, complained

of no pain, but simply a tense feeling in the arms and legs. Later on, under a mixed treatment, these tumors slowly disappeared, having in the meantime been increased by the addition of four more. In their fully developed state—that is, when about two weeks old—they were hard and firm, but later on, they became softer, especially in their central portion, producing a very slight sensation of fluctuation, or, perhaps, I might say, bogginess of the tissues. They never advanced toward ulceration further than this. The redness grew more brownish, and then gradually faded, until at last, in the more dependent ones, slight pigmentation remained, while, in the remaining, total resolution occurred without leaving any trace. The patient was under observation for ten weeks.

In contrast with this case of general and symmetrical distribution, the following are of interest:

Case III.—A female, aged twenty-nine, in the seventh month of syphilis, had several such tumors on the right leg, two on the left arm, and two on the scalp, over the right temporo-parietal region.

Case IV.—A man, aged twenty, six months after infection had several tumors on the legs, one on the right side of the forehead, and one on the chin.

Case V.—A female, aged forty-five, in the tenth month of syphilis, had several tumors on the outer side of both forearms, and one on the left parotid region and infiltration into the soft palate.

The clinical history of this variety of gummatous syphilis is so similar to that of the first that extended description is unnecessary. The appearance of the tumors is the same, except that they are usually larger, perhaps not as much elevated as those of the first form. There is the same stage of condensation, which is slightly longer, then follows that of softening, which is even more aphlegmasic than in the first form. On the legs such complications as chronic eczema, phthiriasis, œdema, varicose veins, and erysipelas, often much modify and intensify the course of these tumors. If resolution takes place, the same process and features are observed as I have already described. If ulceration occurs we find the same softening in one or more central spots, which become of a deep red or black color, then the gradual melting away of the skin until the well-marked gummatous ulcer is left. As in the first variety all the tumors may undergo this necrobiotic action, so in this form one or more may thus succumb, and generally those on the legs. The resulting ulcers are usually large and deep, and correspondingly slower in healing. On the legs this eruption is frequently accompanied by a sensation of uneasiness and heat, and locomotion is more difficult. Elsewhere little, if any, discomfort is experienced, except on the forearms, where a feeling of tension is often complained of.

In general, the diagnosis of this form of syphilide is easy, particularly when the tumors are numerous, and symmetrically distributed. In the cases in which the tumors are sparse and localized, errors in diagnosis

are not infrequently made. It is important to bear in mind that the regions of the head and face are particularly susceptible to this form of precocious syphilide. When thus seated in these regions it is quite frequently found that there is also infiltration into the pharyngeal walls, and perhaps into the mucous membrane of the mouth.

I would not be understood as limiting the date of evolution of this syphilide to the first year of syphilis, since it unquestionably appears later. As the diathesis grows old, however, the eruption generally is less copious, less symmetrical, and is more insidious, aphlegmasic, and limited in extent, becoming more and more like the tertiary form.

### III. The Neurotic Form, Presenting Points of Resemblance to Erythema Nodosum.

Case VI.—A female, thirty-seven years old, married, mother of three children, having suffered from eczema and severe attacks of supra-orbital neuralgia, accompanied by gastric disorder for years, was infected with syphilis by her husband in the winter of 1881. She was a thick-set, fat, and phlegmatic lady, and had never been robust and strong. The secondary manifestations were quite severe, a roseola being soon followed by a copious papular syphilide, distressing angina, and rheumatoid pains. She lived in a neighboring city and was carefully treated with mercurials by her family physician.

In the month of February, 1882, she was brought to me and presented the following symptoms: She had complained of excruciating nocturnal cephalalgia for about ten days. The cervical, epitrochlear, and inguinal ganglia were much enlarged and over the arms and trunk was a declining papular syphilide. The chief object of her visit was to determine the nature of a number of swellings on various portions of the body. On the outer aspect of the shoulders were several oval tumors of a bright rosy red, slightly elevated and convex, having a firm consistence and sharply marginated. Their length was three-quarters of an inch, their diameter half an inch. On the infra-clavicular regions were two tumors, symmetrically placed, slightly larger than the others, and on each forearm were two similar tumors. On each of the legs, on the antero-external surface, were several more of larger size, distinctly elevated, flat, and surrounded by an œdematous margin. Their surfaces were firm and the epidermis quite tense. The color was of a sombre red. The story told by the patient was, that ten days previously, when suffering from severe headache, which was worse at night, she noticed a sense of heat and a soreness as if from a blow or a bruise in the forearms, shoulders, and more severely in the legs. On rubbing these regions she felt lumps under the skin, which, in two or three days, developed into the red tumors just described. While these tumors were forming she was further affected with lancinating pains of intermittent character in the outer aspect of both thighs, beginning at the anterior superior spine of the ilia and running down to the knee. Examination at the time showed that under the skin, on the antero-external surface of both thighs, were two irregular oval plaques of induration fully two inches long. Above them the skin was freely movable and by their inferior surface they were free. No redness of the skin was seen at this time.

I had the opportunity of examining the progress of this case very carefully for a month after the February consultation. The patient was weak, debilitated, and rendered almost hysterically nervous from the suffering during the day by the flushing and lancinating pains and from these combined with headache at night. The tumors were exquisitely painful and the slightest touch was dreaded. It was only after the fourth day, during which time the patient had taken bromide of potassium and codeia, that I could make a thorough examination of the tumors, and I found from the surface thermometer a temperature of 98¾° F. on the tumors. During this period of illness she had lost much flesh. As soon as the pain had been relieved, the codeia was stopped and the bromide, combined with the iodide of potassium, was given in doses, beginning with thirty grains of the bromide and ten of the iodide, three times daily. Besides this, forty grains of mercurial ointment were rubbed into the groins, armpits, and legs near the tumors daily for about ten days. The iodide was pushed to forty grains, thrice daily.

The further history of the tumors is interesting and peculiar. The rosy red deepened into a sombre red, and then in the centre of each, which was slightly convex, the redness gradually paled until a color similar to white wax was left. The tumors then presented a very striking appearance: about one-third of their whole extent and sharply limited to their centres, they were of this waxy color, which was surrounded by an areola of various shades, constituting a peculiar play of colors, such as is often seen in erythema nodosum, and which is admirably shown in plate No. 3 of the late Tilbury Fox's *Atlas of Skin Diseases*. The differences, though, if carefully studied, were well marked. There was a more aphlegmasic, indolent, and subacute appearance to the eruption of the patient. The various shades of circumferential redness were more sombre, the tumors which then could be examined were more sharply circumscribed, and there was decidedly less surface heat than in simple erythema nodosum. Yet I can readily see how an error could have been made.

In proportion as the bromide and iodide were pushed and the mercurial inunctions continued, the nutrition of the patient improved, the appetite returned, the headache ceased, and the neuralgic pains grew less, so that on the twentieth day after the institution of the treatment the condition of the patient was very favorable. The tumors slowly underwent absorption. The waxy colored centre increased peripherally as the variegated and sombre red areola grew less, until in a month the site of the tumors showed only traces of slight hyperæmia. But for fully three weeks after the disappearance of the surface changes distinct nodules, non-adherent to the skin above and the fasciæ beneath, could be distinctly felt. The subcutaneous tumors on the thighs were aborted by the treatment. At first the pain grew less and soon their size diminished, until in about a month they could be no longer felt.

The date of invasion of this eruption was four months after infection.

In the spring and summer of the year 1879, while attending physician to the class of skin diseases at Bellevue Hospital, I had under my care a woman whose case was to me and to my colleague, the late Professor Bumstead, unusual and remarkable.

CASE VII.—The patient was a married woman, twenty-five years of age, of dark complexion, very thin and sallow, who had long lived in the South and suffered from malaria, chiefly in the form of remittent fever and neuralgic pains in the head. She had been infected with syphilis in April and had active and extensive papulo-pustular eruption, double iritis, and nodes on the cranium and on both ulnæ, near the elbow-joint. For these she was treated and was in August free from lesions, when she began to complain of an atrocious nocturnal cephalalgia. This was followed by pain in the larger joints and a marked hyperæsthesia in both legs. Coincidently there were malaise, loss of appetite, insomnia, and, as she tersely described it, a generally wretched condition. After three days of this suffering she observed some red patches or swellings on the legs, chiefly on the middle and upper thirds. I saw her two days after the invasion of this eruption and found her scarcely able to walk. Both legs were swollen, red, and œdematous. On each were fully six large plaques of infiltrated skin. The color was of a deep red, the epidermis tense and shining, and slightly elevated above the intervening skin, which was also œdematous and less red than the tumors. There were two large oval tumors on the outer surface of the thighs. These lesions were hard and firm to the touch and so exquisitely sensitive that it was with much difficulty that an examination could be made. The infiltrations increased in extent, became more salient, while the deep red color became of a bluish-black, exactly like a severe contusion. The intensity of the discoloration was greatest in the centre and shading off slightly toward the periphery. About fourteen days elapsed between the onset of the skin lesions and their full development. At that time the severe neuralgic and rheumatoid symptoms were much relieved and the general condition of the patient better. I was at that time disposed to attribute the relief of the neurotic condition to the large doses of bromide which were given, but subsequent observation has shown me that in some cases in proportion as the eruption matures the suffering grows less. Mauriac has also observed this fact. A point of interest in this case was that several of the tumors so increased in size that they fused together and resulted in patches of infiltration nearly six inches in diameter. Under the mixed treatment and soothing applications resolution took place slowly, except in two of the tumors seated on the lower third of each leg, which softened in the centre, ulcerated, and presented the characteristics of ulcerating gummata.

The period of evolution of this eruption was about fourteen days, the subsequent stationary period was a month for the resolutive tumors and about two months for the ulcerative ones. The date of evolution of the eruption was four and a half months. Very little scarring was observable on the sites of the ulcers.

CASE VIII. was that of a gentleman thirty-two years old, who was under my care in the summer of 1885. He contracted syphilis while abroad and had a small ephemeral initial lesion, followed by very mild secondary manifestations. In the fifth month of his syphilis he became much worried by business reverses and was forced to undergo severe physical and mental strain. In this condition, being a thin, not very strong person, he began to suffer from nocturnal cephalalgia, intermittent neuralgia of several of the left intercostal and of both anterior crural nerves. About a week after the onset of this neuralgic condition he noticed on each leg a number of bright red swellings. These increased

in size and followed precisely the same course as was observed in the first cases. I found the same hyperæsthetic tumors, with a waxy looking centre and the variegated areola. Rather less than fourteen days elapsed from the time of invasion to the full development of the eruption. He was cured by local inunctions and iodide of potassium internally.

Case IX. was that of a woman forty-eight years of age, who was of robust build, but had suffered at intervals during the last ten years with rheumatism. She was much given to alcoholic excess. Ten weeks after infection, which was in December, 1882, coincidently with a copious roseola, she was attacked by an eruption of round and oval tumors on the forearms, legs, and hypogastrium. The deep red color became deeper until a hemorrhagic appearance was presented. Then paling begun in the centre, being first of a bluish-green, then dark green, then of a brownish-yellow, until entire resolution was effected in two months.

Case X. was also that of a woman fifty-three years of age, seen by me in the fall of 1884. She had borne twelve children in fifteen years and thought that the ill health from which she had suffered since she was forty years of age was the result of these frequent pregnancies. She suffered also from subacute bronchitis which had followed pneumonia. Three months after infection she had a copious eruption of the tumors such as I have already described, which were the seat of neuralgia and surrounded by hyperæsthetic skin. Resolution did not take place, the tumors softened and broke down into typical gummatous ulcers, which were healed in three months, during which time a small crop of new tumors developed. Very superficial scars were left.

These five cases, I think, may be taken as typical illustrations of the third form of precocious gummata. The date of evolution of the eruption was respectively four, four and a half, two and a half, and three months after infection, while in Mauriac's cases the eruption began at two months in three cases, four and a half in one, and at nine months in the fifth. In my cases it occurred in women four times and in men once, while in Mauriac's cases three times in men and twice in women. In my cases the ages of the patients were thirty-seven, twenty-five, thirty-two, forty-eight, and fifty-three, while those of Mauriac were thirty-eight, forty-seven, twenty-three, and thirty-four. So that in no case has it thus far been found earlier than the twenty-third year, nor later than the fifty-third.

The clinical history of this form of syphilide has an individuality of its own. In the very early months of the diathesis, either in the stationary period of an early syphilide or at its decline, generally preceded or accompanied by severe neuralgic symptoms involving the facial or cranial, intercostal, anterior crural or, in fact, in any cutaneous nerve, by severe cephalalgia, continuous or nocturnal; by rheumatoid pains in muscles or joints, and by general malaise and debility, this eruption makes its appearance with more or less promptitude and develops quite rapidly. In some instances the invasion is very acute, so that at the end of a week

we may find fully developed tumors an inch or two long, in others and in the majority of instances the development is slower and nearly two weeks elapse. Besides the general neuralgic symptoms, local pains on the site of the lesions or in the whole territory on which they are developed are experienced. These may be continuous or intermittent and in some cases are as excruciating as in severe herpes zoster. They are described as flashing, burning, lancinating, and are sometimes said to resemble those of an abscess. In some instances the sufferings are less after the evolution of the syphilide, but in the majority of the cases the tumors throughout their course are the seat of exceeding hyperæsthesia and patients shrink with terror from their palpation. Besides these phenomena we generally find a moderate febrile movement, an evening temperature of 100° or 101° F., and in the very severe cases as high as 104°; emaciation, want of appetite, and all their concomitant symptoms. The seats of predilection are the forearms and legs, but the tumors are also found on the shoulders, arms, thighs, chest, and trunk. As a result of the pain, swelling, and tension, there are more or less discomfort, stiffness, impairment of motion, even to the extent of a pseudo-paralysis in the arms and legs.

The eruption consists of two orders of lesions: first, tumors or nodosities seated in the subcutaneous tissue and freely movable under the skin and over the fasciæ, though as they increase they may contract adhesions on both surfaces; second, oval or round tumors, or irregular plaques from fusion of tumors. In my experience the subcutaneous nodosities occur much less frequently than the tumors, while Mauriac seems to regard them as almost constant accompaniments to the eruption. The tumors begin by infiltration in the deeper portions of the skin and its contiguous connective tissue. When first seen they are of a bright red, rather sharply circumscribed, and painful. They quite rapidly increase in size into round or oval swellings, slightly raised and convex. In some cases the bright red rapidly becomes darkened until a blackish-red or decidedly ecchymotic appearance is seen, while in others it is of a very deep red, similar to what we see in erythema nodosum. In some cases again the red centre pales and becomes the color of white wax or of a billiard ball, while the deep red border remains in various stages of intensity, consisting of a commingling or play of colors such as we see following a bruise or erythema nodosum. In most of the cases resolution takes place, and there are but two stages: the first, that of condensation; the second, that in which softening takes place, which may, but does not invariably end in resolution. Mauriac is very positive in his assertion that resolution always takes place. In two of my cases ulceration followed softening, and in a case of Dr. Bronson's I observed this same result.

In my Case VII., observed in 1879, ulceration took place and its

occurrence convinced my late colleague, Dr. Bumstead, who watched the case with me, that the eruption which had so puzzled us, in which we leaned to the opinion at first that it was a case of intercurrent erythema nodosum, was really a precocious and then anomalous form of gummata. The ulcerations which follow the breaking down of these tumors present all of the characters of the late gummata, only in a more superficial degree. Their edges are usually not quite as thick nor are their floors as deep, but otherwise the appearances are the same and their subsequent course is usually aphlegmasic and chronic. In exceptional cases general inflammation and swelling attacks a limb or limbs the seat of these tumors, and the suffering is thereby intensified. The tumors are usually symmetrically distributed and remain isolated with little tendency to coalescence. In some cases after being fully formed they may take on renewed action, enlarge, and become fused together.

I was much surprised at the cicatrices following the tumors which underwent degeneration. The extent and depth of the process led me to think that much loss of tissue would result, such as we find in late gummata. But, on the contrary, the resulting cicatrices were comparatively slight and it was evident that great destruction of the skin had not occurred.

In all cases of precocious gummata, the use of iodide of potassium is indicated, either combined with a mercurial or with the use of inunctions of mercurial ointment.

Such, then, is a quite comprehensive description of an eruption which Mauriac, who is the only author who has previously described it, has called syphilitic erythema nodosum. I am utterly opposed to the names of skin diseases, such as lichen, eczema, psoriasis, lupus, etc., with the adjective syphilitic being used to signify eruptions due to the diathesis, since nothing but confusion and inaccuracy can result from such a nomenclature. There is every reason against and none in favor of calling this eruption by Mauriac's title. It is a precocious gumma presenting certain resemblances in its mode of invasion, course, and appearances to the erythema nodosum. The clinical history of the simple eruption is different from that of the specific. In the latter there is the history of recent infection, and usually a coexistence of declining or active syphilitic manifestation. The febrile symptoms of the early gummata are usually not as pronounced as those accompanying the simple eruption, nor is its invasion quite as sudden and rapid as in erythema nodosum, it is more aphlegmasic. In the syphilitic eruption the nervous symptoms are usually much more severe than in the simple form. Should doubt exist in the mind of the observer early in the history of the eruption, as the evolution progresses, and with the history of the case before him, with its more chronic and aphlegmasic course, and its rebelliousness to simple treatment, it will soon be dispelled. The

fact that these tumors break down and take on the appearances and run the course of typical gummata, to my mind, proves beyond doubt their syphilitic origin and nature.

The coincidence of erythema multiforme with syphilis has been observed by Danielssen,[1] Lipp,[2] and Finger,[3] and has been the subject of a recent paper by Bronson,[4] and beyond the fact that in such cases syphilis usually runs a severe course, as I myself have observed, little which is definite or practical has been evolved. The consensus of opinion concerning this coincidence seems to be that these symptoms are the result of angio-neuritic disturbances, and though due to some occult influence of the syphilitic diathesis, are not pathognomonic of the disease. Bronson goes still further in holding that, though they may begin as simple eruptions, they may later on assume a true syphilitic nature.

I am firmly of the opinion, for reasons already given, that the precocious neurotic gummata are purely of syphilitic origin and nature, and not in any sense intercurrent simple eruptions. As in the palate, throat, iris, and periosteum there is often precocious gummatous infiltration, so in the subcutaneous connective tissue of the skin, which is essentially the one upon which the activity of syphilis is spent, may this precocious development take place. In syphilis, as in sarcoma and leprosy, while in general its new growths are slow, aphlegmasic, localized and chronic, in exceptional cases they may be precocious, generalized, and very active.

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## BACTERIOLOGY.

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(FIFTH PAPER.)

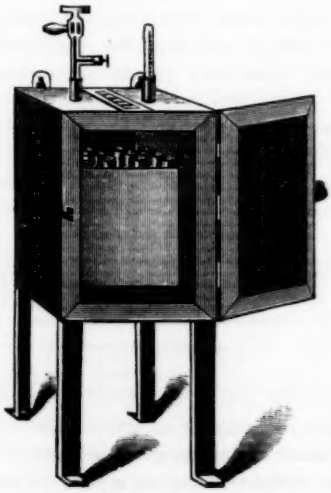
### II. Study of Bacteria by Means of Cultivation.

The two chief aims in carrying on cultivations of a definite species of bacterium are in the first place to get it pure, and in the second place to keep it pure. The methods of getting a pure cultivation and also the methods of keeping it pure, differ under different circumstances, and, therefore, will be best described as occasion arises; but there are certain

[1] Norsk Magaz. f. Laegervidsk, iv. 6. Two notes by Finger.
[2] Archiv für Dermatologie und Syphilis, 1871, vol. iv. page 221.
[3] Ueber den Zusammenhang der multiformen Erytheme mit dem Syphilis-Processe. Prager med. Wochenschrift, 1882, p. 262.
[4] Erythanthema Syphiliticum. Medical Record, September 4, 1886.

points in connection with the second aim which are common to all cultivations. As dust is everywhere, both floating in the air and settled on surrounding objects, and as dust contains large numbers of bacteria or their spores, it follows that all vessels and materials employed in the cultivation and preservation of bacteria are already contaminated. Hence the problem of keeping a cultivation pure resolves itself into two parts—(*a*) the destruction of the microörganisms primarily existing in the vessels and cultivating materials, and (*b*) the prevention of access of new ones. The first thing that must be done then, in connection with cultivations, is to disinfect or sterilize all the vessels employed, and to do this in such a manner that they cannot become reinfected before use. This is done, for the most part, by heat. It has been found, experimentally, that dry heat at the temperature of from 140° to 150° C., continued for two to three hours, effectually destroys all bacteria and spores. Hence all tubes, flasks, and glass vessels in general which will afterward contain cultivating materials, are kept at this temperature for three hours, and, as in the case of tubes or flasks dust might enter during cooling or afterward, their orifices are plugged firmly beforehand with

FIG. 1.



Hot box containing a crate with tubes, and fitted with a thermometer and thermo-regulator.

cotton-wool. It is best to use absorbent wool, because the ordinary wool becomes brown and more brittle than the other. Various kinds of apparatus are used for heating the vessels, of which one is shown in the accompanying sketch (Fig. 1). It consists of a double walled vessel, the outer wall being open at the bottom and there being also a hole at

the top. The door is also double. The gas-flame plays over the open part at the bottom and a current of warm air circulates between the walls so that the interior is equally heated. At the top a thermometer is passed through a hole in both walls into the interior and there is also a place for a thermo-regulator. The form of apparatus shown in the sketch may either stand on the floor or be hung up on the wall—a layer of asbestos paper intervening between it and the wall. It is more convenient than the older forms, where there was no door outside, but where the inside box was enclosed in an outer iron cover. Here the door can be opened and apparatus removed or introduced with great ease and without first allowing the box to cool.

All the other apparatus which comes in contact with the cultivating material, such as inoculating needles, pipettes, etc., should also be sterilized by dry heat. Antiseptic lotions, especially 1:1000 corrosive sublimate solution in water, may be used to purify the outside dishes, etc., in some cases, but they must not be employed for anything which will come in contact with the cultivating material, because a very small quantity of the sublimate will prevent growth. Carbolic acid must also be avoided unless it is afterward washed away, as even the presence of the vapor will hinder development.

There are two classes of cultivating materials employed, viz., fluids and solids. The methods by which these are prepared and used differ a great deal, and must therefore be considered separately.

1. Fluid Cultivating Media.—A great many fluid media have been employed, of which I need only indicate the chief ones. That most frequently used at the present time is an infusion of meat. This may be prepared by cutting up a pound of lean beef into small pieces and placing it in a vessel containing a litre of water. This is set in an ice safe for twenty-four hours, and then by means of a press all the juice is squeezed out of the meat. Where an ice safe and press are not at hand, it is sufficient to keep the material simmering for two or three hours. In either case, the resulting fluid is boiled well so as to precipitate the albumen. It is then filtered and may be at once introduced into suitable vessels. In this condition the meat is acid, but as an acid medium is not a good soil for many forms of bacteria, it is often neutralized with carbonate of soda. This should be done before it is boiled. The infusion can be made still more serviceable by adding about one per cent. of peptone and a little common salt to it. Some prefer for different purposes the flesh of other animals, such as calf, sheep, chicken, etc., but there is not really much advantage in the one infusion over the other.

Various vegetable infusions are also very serviceable. At one time I used an infusion of cucumber very extensively, and found it an excellent material, more especially for micrococci. It is, however, strongly acid, and must be neutralized when required for many forms of bacilli.

Urine was at one time a very favorite medium, but it has fallen into disuse of late. It may be used unboiled or boiled. Urine, as it exists in the bladder of a healthy person, is free from microörganisms, and the problem is therefore to get it into sterilized vessels without contamination. This may be done in the following manner: The glans penis is first thoroughly washed with 5 per cent. carbolic acid solution, and then with 1 : 500 corrosive sublimate solution. Not only is the glans washed, but the lips of the urethra are everted and also washed. The first few drops passed are rejected, as they may be mixed with the disinfecting solutions. The cotton-wool cap of a sterilized flask being removed, its place is instantly taken by the glans penis, and urine is passed into the flask. The cap, which has been held in such a way that the inner surface could not become infected with dust, is then at once reapplied, and the vessel is placed in an incubator, kept at the temperature of the human body, in order to see if it remains pure. For some reason which has not yet been worked out, unboiled urine is not a very favorable cultivating medium; boiled urine, on the other hand, is much better. Hence, as a rule, when urine is employed it is boiled, filtered, and then sterilized by heat.

Cow's milk is also a very excellent cultivating fluid. As the milk exists in the gland of a healthy cow, it is free from bacteria and with suitable precautions can be obtained pure, but the difficulties are great, and boiled milk is quite as good a cultivating material. Fresh milk should be employed, and must be sterilized by heat.

Blood and blood serum are also sometimes employed. The blood is withdrawn with precautions against contamination. The skin is thoroughly scrubbed with antiseptic lotions (carbolic acid and corrosive sublimate), and is then divided with a disinfected knife—in fact, the various steps of the operation are performed antiseptically; when the vein is exposed (the internal jugular vein is the best) a ligature is placed loosely around it, a small incision is made, and a piece of glass tubing, sterilized by passing it through the flame, is tied in. To the end of the glass a piece of India-rubber tubing, which has been boiled, is attached, and the end of this is passed into a sterilized flask, a mass of pure cotton-wool surrounding it at the neck of the flask. When sufficient blood has been obtained the tube is clamped and withdrawn from the flask, and the proper sterile cotton-wool plug is applied. It is often difficult in such a case to get a supply of serum. Sir Joseph Lister observed that when the flasks were sterilized by heat the clot did not contract even after many weeks, and no serum could be obtained. In order to prevent this occurrence it is necessary to agitate the contents of the flask for some time, in the same manner as one whips blood. Blood or serum obtained in this way is, contrary to expectation, a very bad cultivating medium; very often it is necessary to introduce a large number of the bacteria before growth can be obtained. On the other hand, if the serum or blood is diluted with water, growth occurs readily and luxuriantly.

The simplest way of obtaining serum is to withdraw it from the body without taking all the precautions mentioned before, only taking care not to let in more microörganisms than is unavoidable and then, when the serum has separated, to collect it in sterilized tubes and sterilize it by repeated heating to a temperature short of coagulation (about 60° C.) for an hour a day for five or six days in succession.

At one time artificial cultivating materials were a good deal employed, of which the chief were Pasteur's and Cohn's solutions. These have now fallen into disuse because they are by no means favorable cultivating media, only a few species of bacteria growing in them at all readily.

The composition of Pasteur's solution was:

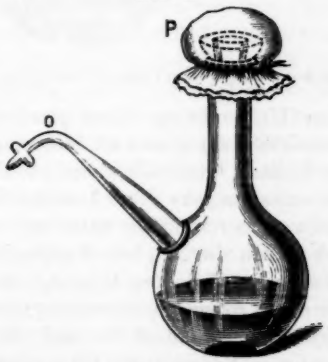
| | |
|---|---|
| Tartrate of ammonia | 1 gramme. |
| Candy sugar | 10 grammes. |
| Ashes of yeast | 1 gramme. |
| Water | 100 c. cm. |

Cohn introduced the following modification of Mayer's solution:

| | |
|---|---|
| Phosphate of potash | 0.5 gramme. |
| Crystallized sulphate of magnesia | 0.5 " |
| Tribasic phosphate of lime | 0.05 " |
| Tartrate of ammonia | 1 " |
| Distilled water | 100 c. cm. |

In using these fluid cultivations it is often convenient to keep a stock solution at hand. For this purpose the flasks introduced by Sir Joseph Lister are very convenient (Fig. 2). These flasks have two necks, a

FIG. 2.

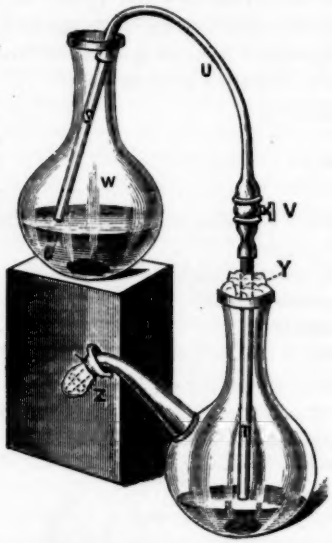



Lister's flask for preserving cultivating materials. O, the narrow neck. P, the cotton-wool cap.

large vertical one and a lateral one, which is a bent spout, large at its commencement and comparatively narrow at its shorter terminal part beyond the bend, O. The large size of the first part of the neck prevents it acting as a siphon, and the result is that when liquid is

poured from such a flask, and the vessel is afterward restored to the erect position, the end of the nozzle remains filled with a drop of the liquid, and this guards the orifice so that regurgitation of air can never take place through the nozzle. Before sterilizing these flasks a cap of cotton-wool is tied over each orifice so as to prevent the entrance of dust. In filling these flasks (Fig. 3) it is best to introduce the fluid into them

FIG. 3.




Method of filling a Lister's flask (see description).

by means of a siphon (U), consisting of two glass tubes connected by two pieces of India-rubber tubing with an intervening stop-cock (V). The siphon is first completely filled with water, and then one leg (S) is placed in the vessel containing the filtered cultivating material (W), and the tap is turned so as to run off the water and replace it with this fluid. The stop-cock is then shut, a piece of carbolized rag is wrapped around the lower extremity of the free tube and applied to the mouth of the flask as soon as the cotton cap is removed; the tube (T) is then pushed steadily down to the bottom of the flask (X), through the carbolized rag (Y), the stop-cock turned, and the required amount of fluid introduced. When this has been done the tap is again turned off, the siphon withdrawn through the antiseptic rag, and a fresh cap of sterilized cotton-wool is tied over the mouth of the flask when the carbolized rag is removed. The fluid is then sterilized and can be kept for any length of time. A portion of the fluid can be poured out of the flask

into smaller vessels from time to time without injury to the stock solution. To do this the cotton cap is removed from the nozzle of the flask, and the end of this is instantly slipped through an opening in the centre of half an India-rubber ball which has been previously sterilized (Fig. 4, R). The protecting plug or cap having been removed from the vessel to be filled, the India-rubber cap instantly takes its place, thus preventing all entrance of dust, and the requisite amount of fluid is poured into it. When this is done, the sterile plug is again inserted into the newly filled vessel. The India-rubber ball is then removed from the flask, the drop of fluid

FIG. 4.

Method of filling vessels from a Lister's flask. R, half an India-rubber ball through which the nozzle is passed.

FIG. 5.

Erlenmeyer's flask.

which remains in the nozzle sucked away with a carbolized rag, and a fresh sterilized cotton cap is applied. With a little practice these manipulations can be carried out in such a way that neither the fluid in the stock solution nor that in the newly filled vessel is contaminated; but it is well to make quite sure of this by sterilizing both again. If it is necessary to know exactly the quantity of fluid in the flask or tube, it must be filled by means of a graduated pipette or burette.

For cultivating purposes the vessels generally used are test tubes or flasks, the form known as the Erlenmeyer flask (Fig. 5) being the best. The necks of the tubes and flasks are generally tightly plugged with cotton-wool before they are sterilized in the hot box. The objections which I have to this method are that dust collects on the top of the wool and in pulling out the plugs some particles may fall into the interior. The danger of contamination can generally be avoided by igniting the top of the plug before it is removed, thus destroying any living germs which may be present in it. But particles of dust may have passed down for some distance between the wool and the glass, and may escape destruction. This is not of so much moment where the cultivations are solid, because the vessels may be held very obliquely or even upside down, but where fluids are used it is not so easy to prevent their admission. For this reason, when I use fluids I generally employ flasks and not test tubes, and instead of plugging their necks I tie the wool over

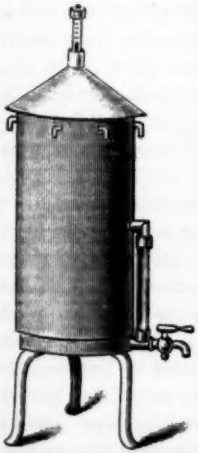
the orifice, and, as after sterilization the wool is more powdery, I enclose the mass of wool in a double piece of gauze (Fig. 6, A). The mass is bent over the mouth of the flask and secured round the neck by copper wire. Before opening the flask I wet the edge of the wool all round with carbolic lotion and also moisten its whole surface. Thus, even though the carbolic acid may not have destroyed the spores on the wool, the moisture fixes them so that they do not fly about when the wool is lifted. Another advantage of this arrangement is that the wool need not be completely removed from the orifice of the flask, but one side may be lifted and any instrument slipped into the flask under cover of the cap.

Fig. 6.

Flask with cotton-wool cap containing cultivating fluid inoculated by means of a capillary tube.

The culture fluids having been thus prepared, filtered, and introduced either into the stock flask, or into the smaller flasks, must be sterilized because, during filtration and the other manipulations, they have become contaminated from the air and surrounding objects. This sterilization is best effected by means of Koch's steaming apparatus (Fig. 7). This is a deep iron or tin vessel in the bottom of which water is placed, and just above the water is a tray on which flasks, etc., can stand. The lid fits loosely and both the lid and the vessel itself are surrounded with felt. The water in the interior is boiled till steam issues from the top, and till the thermometer passed through the lid indicates almost 100° C. The vessels containing the culture fluid are then introduced and allowed to remain for from half an hour to an hour. The result is that all bacteria not in the spore state are killed. Following Tyndall's experiments the flasks are then set aside in a moderately warm place for twenty-four hours. By that time spores, if present, will probably have sprouted and, therefore, the steaming process is repeated. To make the sterilization quite certain, another twenty-four hours are allowed to elapse and again the flasks are heated. The result of this is that one may reckon with certainty that all bacteria present in the fluid are destroyed. This is a much better way of proceeding than the old plan of boiling the fluid, because in boiling the fluid a large amount of evaporation occurs, and its constitution is, therefore, altered, and also if any portions of the original impure fluid have remained at the top of

Fig. 7.



Koch's steaming apparatus for sterilizing culture materials.

the flask, or been splashed up during the bubbling, they may not be sufficiently heated and may afterward contaminate the mass. On the other hand, in the steaming apparatus the whole flask is equally heated and sterilized. Indeed, with such fluids as milk this is the only possible way of sterilizing them, because on attempting to boil milk a scum forms on the surface and the milk either boils over or is imperfectly sterilized.

In the case of blood serum, as has already been said, the temperature should not be raised above 60° C., for coagulation occurs at 65° C. It has been found, however, that an hour's exposure to 60° C. is sufficient to kill almost all adult bacteria, and one may reckon that if this process is repeated for, say, five or six days in succession, the serum will be completely sterilized.

After the process of sterilization is complete the vessels should be placed for three or four days before use in an incubator kept at the temperature of the human body, in order to be certain that the material is thoroughly sterile.

These flasks may be inoculated in various ways, but more care is requisite than in the case of solid cultures, and a number of flasks must be inoculated at the same time in order to guard against error. The same method may be employed as in the case of cultures on solid media, viz., a piece of thin platinum wire is fixed in the end of a glass rod—a thing easily done by heating both in a Bunsen flame and then pushing the wire into the soft glass—and this wire being heated and allowed to cool is dipped in the material to be tested and then introduced into the fluid under cover of the cotton-wool cap. This can be rapidly done, as a mere touch is sufficient to infect the fluid.

In my early experiments with discharges from wounds[1] I employed the following plan with complete success. Small capillary tubes, those used for vaccination for example, are passed through the flame several times to sterilize them. The end is then applied to the wound and at once a small quantity of the discharge runs up into the tube. The edge of the cotton-wool cap being now lifted, the tube is then dropped into the flask and the cap reapplied (see Fig. 6).

Another plan which I employed when inoculating a second flask from the first, was to use a piece of glass tubing bent at right angles and attached by means of a small bit of India-rubber tubing to a small brass syringe, the piston of which had a ring at the end. The cap of the first flask being slightly raised at one side, the tube, previously heated in the flame and allowed to cool, was introduced into the flask, a small quantity sucked up by withdrawing the piston slightly by means of the little finger passed through the loop and then the cap of the second flask being lifted a drop was expelled into it. With a little practice this

[1] Antiseptic Surgery, p. 230.

manipulation can be performed rapidly and safely. By the same manœuvre small quantities can be withdrawn for microscopical examination as before described.

The above methods are what I have found quite sufficient to enable me to carry on cultivations in fluids with great ease and certainty, but numerous other plans have been described. Pasteur employs a number of peculiar shaped flasks for the preservation of fluids, but as these have no advantage over the Lister flasks, and are more complicated, I need not mention them. The flasks which he uses for cultivations are, however, very simple (Fig. 8). The outside of the necks of these flasks is ground, and over this a glass cap (A), ground inside, fits tightly, and the upper part of this cap, which is narrowed, is plugged with wool, asbestos, etc. The cap is lifted for purposes of inoculation, examination, etc.

Sternberg describes his method as follows:[1] "The culture flasks employed contain from one to four fluid-drachms. They are made from

FIG. 8.

Pasteur's cultivating flasks. A, glass cap. (After Hueppe.)

FIG. 9.

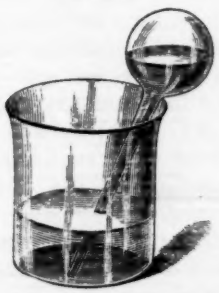
Sternberg's bulb containing culture fluid, and ready for use.

glass tubing three- or four-tenths inch diameter, and those which the writer has used in his numerous experiments have all been home-made. It is easier to make new flasks than to clean old ones, and they are thrown away after being once used. Bellows, operated by the foot, and a flame of considerable size—gas is preferable—will be required by one who proposes to construct these little flasks for himself. After a little practice, they are rapidly made; but as a large number are required, the time and labor expended on their preparation is no light matter. After blowing a bulb at the extremity of a long glass tube of the diameter mentioned, this is provided with a slender neck, drawn out in the flame, and the end of this is hermetically sealed (Fig. 9). Thus

[1] Magnin and Sternberg: Bacteria, p. 176. Wood & Co., New York, 1884.

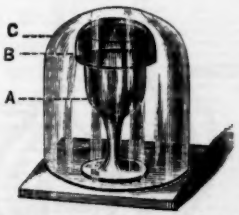
one little flask after another is made from the same piece of tubing, until this becomes too short for further use. To introduce a culture liquid into one of the little flasks, heat the bulb slightly, break off the sealed extremity of the tube, and plunge it beneath the surface of the liquid (Fig. 10). The quantity which enters will, of course, depend upon the heat employed, and the consequent rarefaction of the enclosed air. Ordinarily the bulb is filled to about one-third of its capacity with the culture-liquid, leaving it two-thirds full of air for the use of the microscopic plants which are to be cultivated in it." These fluids are then sterilized by the usual methods, and the flasks are kept in an incubator for several days, to make sure that they are pure. "To inoculate the liquid contained in one of these little flasks with organisms from any source, the end of the tube is first heated to destroy germs attached to the exterior; the extremity is then broken off with sterilized—by heat—forceps; the bulb is very gently warmed, so as to force out a little air, and the open extremity is plunged into the liquid containing the organism to be cultivated. The smallest quantity of this is sufficient, and as soon as the

Fig. 10.



Method of filling Sternberg's bulbs with culture fluid.

Fig. 11.




Apparatus employed by Sir Joseph Lister in his experiments on lactic fermentation. A, liqueur glass. B, small glass cap. C, large glass shade covering the whole.

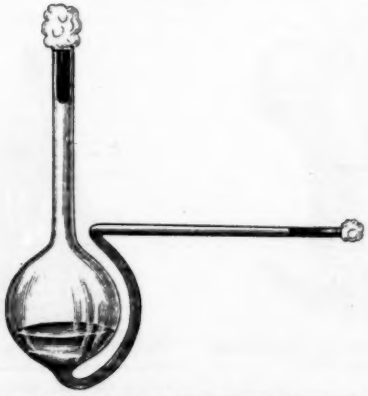
inoculation is effected, the end of the tube is again sealed in the flame of an alcohol lamp. A little experience will enable the operator to inoculate one tube from another; to introduce a minute quantity of blood containing organisms directly from the veins of a living animal; to withdraw a small quantity of fluid from the flask for microscopical examination, etc., without any danger of contamination by atmospheric germs."

Sir Joseph Lister, in his experiments on lactic fermentation, employed a liqueur glass (Fig. 11, A) covered by a glass cap (B), both being covered by a glass shade (C), the glass and the shade standing on a glass plate.

The shade is removed, and the glass cap being lifted for a moment, the contents of the glass can be readily inoculated.

Fluid cultivation materials possess advantages in special cases, though for most purposes they have now given place to solids. One advantage which they have over certain solids is that they can always be placed in an incubator at the temperature of the human body without the result being in any way spoilt, whereas with certain solid media, such as gelatinized media, this cannot be done. In experiments on the growth of bacteria in different gases, fluid media are especially useful, and it is by no means easy with solids to insure that all the air is displaced by the gas to be tested. In my report on micrococci in relation to wounds, abscesses, and septic processes,[1] I described a very simple and efficient plan which I had devised for this purpose. Into the bottom of a glass bulb capable of containing about one ounce of fluid, and having a neck six inches long and about half an inch in diameter, is sealed the end of a long, narrow tube, which is bent up round the side to the top of the bulb, and

FIG. 12.



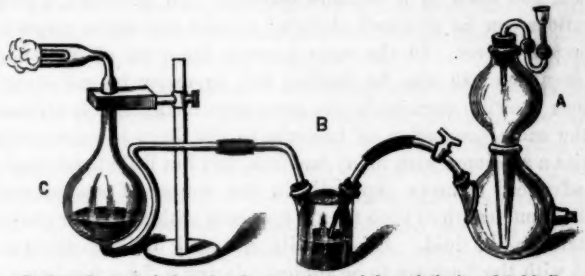
Bulb for testing the influence of various gases on the growth of bacteria.

then runs out for about four inches in a horizontal direction. The end of this tube is well plugged with cotton-wool, a cotton-wool cap is tied round the opening of the neck, and the whole apparatus is sterilized in the hot box (Fig. 12). The purified infusion is then introduced with the usual precautions into the bulb, so as to fill about one-third of it, the cap reapplied, and the infusion sterilized again in the steaming apparatus, if necessary. The bulb is then placed in the incubator for some days to make sure that the fluid is sterile. When the experiment is to be performed the cap is lifted, the fluid inoculated with the bacteria in the

[1] British Medical Journal, September and October 1884.

manner formerly described for flasks, the cap reapplied, and the neck bent to a right angle and drawn out fine, so as to be ready for rapid sealing. The end of the other tube is then connected with the apparatus for generating and washing the gas, and the gas is passed through the

FIG. 13.




To show the method of passing the gas to be tested through the inoculated bulb. A, the gas generator. B, wash bottle. C, bulb containing the inoculated fluid.

fluid until the latter is thoroughly impregnated with it, and the air in the bulb has been entirely displaced (Fig. 13). The time required varies with the rapidity of the flow of the gas, but ten minutes are, as a rule, amply sufficient. The flow of gas is now stopped, and the neck and the small tube sealed in the flame of a spirit lamp (Fig. 14). Thus there is only the gas to be tested in contact with the fluid, and no possibility of entrance of other gases from without. The apparatus can now be placed in an incubator.

FIG. 14.

Bulb with both ends sealed after the gas has been passed through it.

Another purpose, for which fluid media is employed, is for drop cultures. (See under "Microscopical Examination of Unstained Specimens.") Cupped slides are cleansed and passed through the flame, or heated in the hot box, in a beaker plugged with cotton-wool. At the same time. thin cover-glasses are heated by passing them several times through a gas-flame, and are then laid on a glass plate, and allowed to cool under cover from dust. A small drop of the culture fluid is then placed on the centre of the glass, and inoculated with the material to be studied. A little vaseline is put round the margin of the cell, the slide inverted and pressed down on the cover-glass, so that the drop is opposite the centre of the coil, and the slide then rapidly turned upward. These drop cultures are very convenient for observing the movement and growth of bacteria, and for the latter purpose, and for the study of spore formation and sprouting of spores, I have used them extensively. The

sprouting of spores[1] may be readily followed by inoculating a number of these cupped slides with spore-bearing material, and placing them in an incubator. Remove one at stated intervals (say, one hour, one and a half hours, two hours, etc.), lift up the cover-glass, turn it over, and dry the drop of fluid. When dry wipe off the vaseline from the margin of the glass, and stain in a suitable material. In this way, a series of preparations can be obtained, showing all the successive stages in the sprouting of spores. In the same manner, the cycle of growth of an adult organism can also be studied, but, in order to get a series of specimens showing accurately the successive changes, it is necessary to have the same proportion of bacteria to the fluid in each specimen, otherwise a specimen with many bacteria, and but little fluid, may show more advanced changes, especially in the matter of spore-formation, after the same length of time than a specimen with a smaller proportion of bacteria to the fluid. This is easily managed by inoculating a flask of fluid with the bacteria to be studied, placing it for a few hours in an incubator, and shaking it well before taking the drops from it. The bacteria will thus be equally distributed through the fluid, and a fairly accurate series of specimens can be obtained.

As has just been said, fluid cultivations have dropped greatly into disuse of late, on account of very serious disadvantages which they possess, and on account of the many advantages obtained by the employment of solid culture media. The two great disadvantages of fluid media are, that if they become contaminated, the cultivation is spoilt, because the newcomers mix thoroughly with the original bacteria, so that further inoculations from such flasks simply carry over the two kinds. The second disadvantage is, that the original culture must be started from a material containing only one kind of bacterium, for it is extremely difficult with fluid media to separate one form from another. This separation has been attempted in various ways, but these are far too difficult, and require too much time to render them practically useful.

The old plan was, to arrange the composition of the cultivating material, so that it was more suitable for the growth of the desired species than for other species. Then, by fresh inoculations daily, as small a portion as possible of the inoculating material being taken, it was hoped that the desired species would gain the upper hand, and ultimately be obtained pure. This hope was, however, but rarely realized.

The best method was that used by Sir Joseph Lister in his experiments on lactic fermentation, and proposed also independently by Nägeli about the same time. A series of flasks of milk were prepared and sterilized. The milk containing the *Bacterium lactis*, along with other bacteria, was then taken and an attempt made to estimate the number of bacteria in each drop. This was done by placing one-fiftieth of a minim

[1] See paper on Bacillus Alvei. Journal of Royal Microscopical Society, August, 1885.

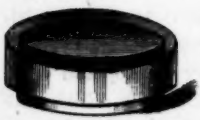
on a cover-glass of such a size that when pressed down on the slide the drop occupied exactly the area of the cover-glass. The number of bacteria in this quantity was next calculated, and then the milk was diluted with boiled water to such an extent that every hundredth of a minim was estimated to contain one bacterium. To each of the glasses containing the pure milk one-one-hundredth of a minim of the diluted fluid was then added and the result was, that in a certain number a pure cultivation of *Bacterium lactis* was obtained.

2. Solid Cultivating Media.—If a boiled potato is sliced and exposed to the air, it will be seen in a few days that the surface of the potato is dotted over with spots of various sizes, some colored, some white, some slimy, some dry, etc. These spots are groups or colonies of various microörganisms, and each has developed from one or a clump of individuals which has fallen on it from the air. In the early stage, while these colonies are yet small, most of them are isolated, so that each of them generally represents a pure cultivation of one or other form of microörganism. If now a small portion of one of these colonies is transferred to a fresh potato by means of a heated knife or needle, and the potato kept in a moist chamber and protected from dust, a pure cultivation of the organism is obtained. Should any stray organisms fall on the surface of the potato during the procedure, they develop and form colonies where they fell, and, therefore, do not necessarily vitiate the whole of the original culture, portions of which can be found which are pure and from which fresh cultures can be made. One very great advantage of cultivations on solid media over cultivations in fluids is thus at once evident, viz., that while the entrance of an accidental impurity entirely vitiates a fluid culture, it does not necessarily spoil one on a solid medium. Potato has been used as a culture medium by several investigators (*e. g.* Schroeter), before Koch's time, and Brefeld and Klebs also employed gelatinized materials, but this was with the view of preventing evaporation, and also of enabling one to turn cultures on glass slides upside down so as to prevent dust falling on them. It was Koch who first recognized the value of solid media in enabling the investigator to get and to keep cultures pure, and in his hands the methods have been elaborated and simplified so that they are now universally adopted. In order to obtain a transparent solid culture medium, Koch employs infusions solidified by the addition of gelatine, agar-agar, etc. These gelatinized materials have turned out to possess other great advantages besides those of enabling one to get and to keep a cultivation pure. It is found that the shape and mode of spread of the colonies vary in different kinds of bacteria which may be microscopically similar, that one spreads only on the surface, another only in the interior of the jelly, one renders the gelatine liquid, another leaves it solid, etc. To such an extent are these peculiarities distinctive that in several instances the diag-

nosis between two organisms is made almost entirely by their behavior in jelly cultivations rather than by their microscopical appearance, and in all cases attention must be paid to their behavior on cultivation in various media, and to their other characteristics as well as to the microscopical appearances, before deciding as to the species of bacterium under observation. I shall now describe the mode of preparation and use of the materials most frequently employed.

*a. Potato.* For potato cultivations ripe potatoes are best, the small new potato not being nearly such a good medium. As the earth on the outside of the potato is full of bacteria and spores, it must be washed off as much as possible and the eyes of the potato cleaned out. The potato is then laid in a 1 to 1000 watery solution of corrosive sublimate for about an hour. Afterward it is washed in water and placed in the steaming apparatus and kept at the temperature of 100° C. for a half to three-quarters of an hour. It is then allowed to cool under cover from dust. In the meantime a couple of glass dishes, one larger than the other so as to form a cover, are washed out with 1:1000 sublimate solution, and a piece of filter paper moistened with the same solution is placed on the bottom of each, so that when the one is inverted over the other there is a moist surface at the upper and lower part of the chamber.[1] This is to keep the air moist so that the surface of the potato does not dry.[2] The potato after being cooked and cooled is cut into two halves in the following manner: A long flat knife is heated in the flame and allowed to cool. The left hand is then dipped into 1:1000 sublimate solution and the potato is taken up with it. With the knife held in the right hand a single sweep is made through the potato, and the cover of the moist chamber being lifted, the two halves are separated and laid down with the cut surfaces uppermost. The cover is then replaced and the potato is ready for inoculation. In some cases, where the potato is to be placed at the body temperature and kept for some time, tall narrow vessels similar to those used by Koch for testing air (Fig. 26), plugged with cotton-wool and sterilized, and large enough to hold half a potato, are employed.

FIG. 15.



A pair of glass dishes forming a moist chamber and used for potato, plate cultivations, etc.

The surface of the potato may be inoculated by the platinum wire before described, or by a thin, flat knife, by means of which the material is rubbed over the surface of the potato. The knife or needle is dipped in the cultivation to be inoculated and drawn rapidly over the surface of the newly prepared potato.

*b. Gelatinized materials.* Solid and transparent cultivating media

[1] Where these glass dishes are not at hand a very excellent substitute is a soup plate with a meat plate inverted over it, each having been washed with the sublimate solution and provided with the moist blotting paper.

can be made by adding from five to ten per cent. of gelatine to any of the fluid media previously mentioned. The material, however, which seems most universally useful is a meat jelly of the following composition:

| | |
|---|---|
| Meat, finely chopped | 1 pound. |
| Water | 1 litre. |

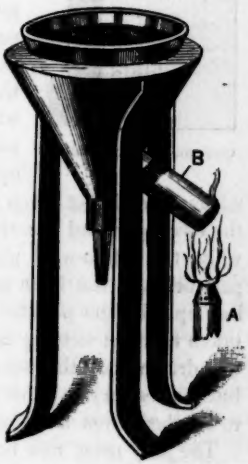
To the meat extract thus obtained add:

| | |
|---|---|
| Peptone | 10 to 30 grammes. |
| Chloride of sodium | 5 " |
| Gelatine | 100 " |

Neutralize or render faintly alkaline with carbonate of soda.

The meat and water are allowed to stand in an ice safe for twenty-four hours. At the end of that time the water is strained off and the fluid contained in the meat is obtained by pressing it in a press, this fluid being added to the rest and the whole made up to one quart. This meat extract is now boiled to precipitate the albumen, then the peptone, common salt, and gelatine are added to and dissolved in it, and the whole carefully neutralized by means of carbonate of soda. The mixture is now filtered through a warm water filter, of which the most convenient form is shown in the accompanying diagram (Fig. 16). It consists of a glass funnel fitted into a copper funnel with a space between them in which water lies.

FIG. 16.



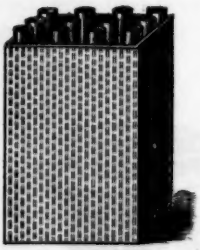

Hot water filter.
A, Bunsen flame playing on the brass arm B.

At the lower part the glass funnel passes through an India-rubber cork which is fixed firmly into the lower opening of the brass funnel, thus rendering the cavity water-tight. In one form a hollow brass arm is attached to one side of the brass funnel and the water in the funnel also passes into this arm. By means of a lamp placed under this arm the water is kept warm. In another form there is no arm, but the filter hangs in a ring which is a hollow tube through which the gas comes, and which has a number of small burners on it. Very often the material must be filtered more than once before it is quite clear. In hot weather, if the filtration occurs slowly, the jelly is apt to be spoilt by decomposition before it is ready. To facilitate matters I have made use of the cook's plan of clearing jellies by means of egg albumen. While the material is cool add to it the whites and shells of two or three eggs, mix well, then place on the fire and boil violently for about fifteen minutes. Care must be taken to remove the

pot and scum several times during this process, otherwise the material is apt to boil over. Then strain through flannel. The result is that with the heat the egg albumen coagulates and rises to the surface as a scum, carrying with it all the grosser particles, and leaving the fluid fairly clear. When this has been strained it should be made up again to a quart, filtered and tested to see if it has become at all acid, for if so it must be again neutralized. It will now be found to run through much more quickly. In filtering it, the top of the filter should be covered with a plate or saucer to prevent the upper part of the filter paper from drying up, and the filtrate should be received into a purified vessel.

The jelly, when filtered, is again made up to a quart and may be placed in a pure flask, sterilized, and kept as a stock material, but it is usually put at once into the smaller vessels, in most cases into test-tubes. The test-tubes are washed, plugged with cotton-wool, and sterilized in the hot box as previously described. It is very convenient, for the purpose of handling the tubes, to place them in crates of galvanized iron-wire net (Fig. 17) each holding about twenty or thirty tubes. They are sterilized in this. When filled they are again arranged in the crate, and can be conveniently placed in the steaming apparatus, taken out again, etc.

FIG. 17.



Crate containing test-tubes.

The tubes may be filled in various ways; generally about one-fourth of their interior is occupied by the jelly. In many cases it is important to know how much jelly is present in the tube, and for this purpose the tubes are filled with a sterilized graduated pipette. Generally about 10 c.cm. are put into each tube. The operation is performed in a room but little used, where there is not much dust flying about. The tube is taken between the forefinger and the thumb and held obliquely or even upside down, while the cotton-wool plug is extracted. This is caught by the outer part between the little and ring fingers, the tube is then held more or less upright, the pipette with the jelly rapidly introduced, care being taken to avoid wetting the neck of the tube, the pipette emptied and withdrawn, and the cotton-wool plug reinserted. When it is not absolutely necessary to know the exact quantity it is much more convenient to fill them from a Lister flask in the manner before described.

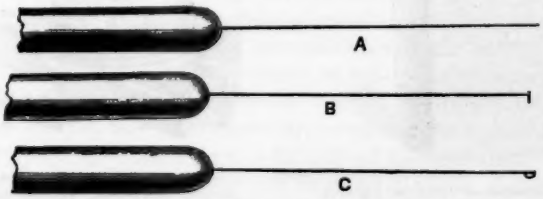
The jelly must now be sterilized, and this is done by means of the steaming apparatus as before described with fluids. The steamer having been raised to 100° C., the crates or flasks are introduced, and left in it for ten minutes or a quarter of an hour, and this is repeated on three successive days. Care must be taken not to heat the jelly long or too often, for heat converts the gelatine into acid gelatine, which does not

solidify. Thus, if the tubes were kept at the temperature of 100° C. for an hour or more for three successive days, the jelly would probably not set at all or only do so very imperfectly. The tubes are now set aside for some days at a moderate temperature (16° to 20° C.) to see if they have been properly sterilized. If the jelly remains quite clear and free from the development of colonies, it may then be used for experimental purposes. When the jelly has been kept in the tubes for some time it evaporates at the upper part, and then when a wire is introduced to inoculate it, it splits. Hence, old jelly should be liquefied and allowed to set again before use.

There are three chief modes of using the jelly for cultivations; these may be termed test-tube cultivations, plate cultivations, and glass slide cultivations. The temperature at which the material should be kept varies from 16° C. to 23° C. or 25° C. Good 10 per cent. gelatine is just solid at 25° C., while very few organisms grow at all well below 16° C. The best temperature for growth and for solidity is from 20° C. to 22° C.

In test-tube cultivations the jelly is allowed to solidify in tubes placed perpendicularly. To inoculate these tubes, the platinum wire fixed in the glass handle is employed (Fig. 18, A). The wire should be quite

FIG. 18.



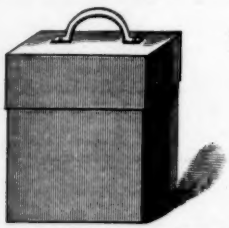

Platinum needles for inoculation. A, straight needle for inoculating tubes. B, bent needle for glass slide cultivations. C, looped needle for plate cultivations. (After Crookshank.)

straight and thin. The cotton-wool plug is set on fire to destroy all the dust on its outer surface. The tube is then held obliquely between the fore and middle finger, the plug withdrawn, and caught by the outer part between the ring and little finger, the wire which, as well as the adjacent piece of glass rod, has been heated and allowed to cool, is dipped in the material to be inoculated and rapidly plunged into the jelly right down to the bottom of the tube. It is then withdrawn, the plug reinserted, and the tube placed upright at a suitable temperature. Where one tube is to be inoculated from another, the new tube is held between the fore and middle fingers well up to the web, and the old tube between the middle and ring fingers near their tips, and the cotton-wool of the new tube is first removed. The idea is that if all the dust in the corks

is not destroyed by the burning, it will not much matter if that from the cork of the new tube falls into the old one; whereas, if the opposite were the case, the new cultivation would be spoilt. The result of this method of inoculation is that growth may occur either along the track of the needle in the interior of the jelly, or on the surface, spreading from the point where the needle entered the jelly, or at both places, and from this and from the characters of the resulting growth, valuable information is often obtained as to the kind of bacterium under observation. In some cases where only a surface growth is wanted, it is most convenient to allow the jelly to solidify obliquely, and then inoculate the surface by drawing the infected needle over it. In keeping up a series of cultivations these test-tube cultivations are always employed.

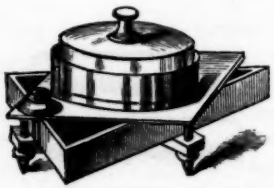
Plate cultivations are of great value for many purposes—*e. g.*, for separating bacteria from one another in a mixture; for studying the characteristics of particular forms; for ascertaining the number present in any material, or whether any are present at all, etc. In this method of cultivation a tube is inoculated with the material to be investigated; the jelly is liquefied at the body temperature; it is then well shaken to

FIG. 19.



Iron box in which the glass plates used for plate cultivations are sterilized and kept.

FIG. 20.



Arrangement for providing a level surface for plate cultivations. The plan described in the text for rapid cooling by means of iced water is not shown in this drawing.

diffuse the bacteria throughout it, and before it sets it is poured out on a sterilized glass plate, which is afterward kept at a proper temperature in a moist chamber, protected from dust. The glass plates are flat pieces of glass, generally oblong in shape, and measuring about six inches by four. They are cleaned and placed in an iron box like that shown in Fig. 19. This box containing the plates is sterilized in the hot box in the usual manner. The dishes used for keeping the plate cultivations are similar to those employed for potatoes, and are prepared in the same manner. Several plates may be placed in the same dish by using a series of glass supports placed one above the other. These are easily made by taking a long narrow piece of glass, and fastening to one side of it at each end a thick glass bar by means of Canada balsam. In

pouring out the liquid jelly on these plates, it is important that they should be level, and also that the jelly should set quickly. For this purpose the following arrangement is employed: A large wooden triangle is supported by three screws, which can be raised or depressed. On this triangle a large piece of glass is placed (Fig. 20). By means of a spirit level and the screws this plate can be made quite level. On this plate a glass dish is set, which is filled quite full with ice and water, and over this another flat piece of glass is placed. The surface of this glass is levelled. On this top piece of glass the glass plate is laid and protected from dust by means of a glass cover. The liquid jelly is poured out on this plate and diffused evenly over it by means of a sterilized glass rod. It sets almost immediately, and can then be placed on a glass tray in the prepared dish, and another plate made, and so on.

The result is that the bacteria being well diffused throughout the jelly, each one that is capable of growing in the material does so, and thus a number of masses or colonies of bacteria appear in a few days throughout the jelly, each of these having presumably started from one individual. Hence, by counting the number of colonies, one may arrive at the number of individual bacteria introduced. Again, experience has shown that different species of bacteria form colonies of different appearances. Some are round, some oval, some smooth, some tuberculated; some have threads shooting out from them into the jelly; some are colored, some not; some cause liquefaction of the gelatine, others do not, and so on. By observing the characteristics of the colonies one may arrive, by means of plate cultivations, at some conclusion as to the species of organism under observation. Again, by means of this method, one can not only enumerate and recognize the bacteria, but can also get pure cultivations from a mixture of different kinds. For if the bacteria and the liquid jelly are thoroughly mixed, and if the jelly solidifies rapidly, each colony will probably start from a single bacterium, and hence each colony will represent a pure cultivation. In separating different kinds, one would not, however, be content with a single plate cultivation; one would make a second set of plates from the colonies on the first. If all the colonies in the second series of plates are similar, one may assume the purity of each, and make test-tube cultivations from them.

The examination of these plates may be carried on with the naked eye, with a pocket lens, or under a low power of the microscope. In the very early stage the colonies are so small that they can only be seen under the microscope, but after a few days they can be seen and recognized by the naked eye or pocket lens. In all examinations microscopic investigation with one-half or one-quarter inch objectives should be combined with the examination by the naked eye or pocket lens. Being an unstained specimen a small diaphragm is, of course, employed.

For any of the purposes for which plate cultivations are employed, it is a disadvantage to have too many colonies on one plate. This may be avoided in various ways. Where the object is simply to get plate cultivations for diagnosis, or for pure cultivations, I generally proceed in this way. Take, say, four tubes of jelly and liquefy them, and, in burning off the tops of the cotton-wool corks, heat also the necks of the tubes. Allow them to cool, and introduce a minute quantity of the material to be tested into tube No. 1. Shake it well, and pour one or two drops from No. 1 tube into No. 2. Shake No. 2 well, and pour a drop or two into No. 3, and so from No. 3 into No. 4. Then make plates from each. In No. 1 plate the colonies will certainly be too numerous, in No. 2 this will also be the case, but in No. 3, and especially in No. 4, only small numbers will be present. The reason for heating the necks of the tubes is to avoid contamination as the jelly is poured from the one tube to the other. Koch's plan is to twist the end of the platinum wire into a small loop (see Fig. 18, C). Dip this loop into the bacteric mixture, and pass it into the jelly in tube No. 1. This is shaken up, and from this tube three loopfuls are carried into tube No. 2 by dipping the loop three times into No. 1, and rinsing it out each time in No. 2. From No. 2, after being shaken up, six loopfuls are transferred to tube No. 3. Plates are then made from each. Where it is necessary to know the number of bacteria in the original material, one must proceed differently. A given quantity, say, fifteen minims, of the original material is added to a given quantity of boiled distilled water, or salt solution (one-half per cent.). This mixture is well shaken up, and then a small quantity (say, two or three minims) is added to each tube of jelly, and from these plate cultivations are then made. In this way, by a simple calculation, the number of bacteria in a given amount of the original material can be ascertained.

Esmarch has introduced a plan of separating bacteria, which is useful in the absence of the apparatus for plate cultivations. Instead of pouring out the contents of the inoculated tube, the latter is turned on its side and rotated, under a stream of cold water, till the jelly solidifies. The whole of the side of the tube is thus lined with a thin layer of jelly in which the individual colonies appear; they can be counted and recognized by means of a pocket lens, or under a low power of the microscope.

Of course, in these processes there is a certain risk of contamination. Contamination from the neck of the tube is avoided by the precaution I suggested before, of heating the neck, and allowing it to cool before pouring out the material. Contamination from the air is avoided by rapidity of movement, and by operating in a still room. The disturbing effects of an accidental contamination are also, to a great extent, neutralized by using the ice, so that the gelatine solidifies quickly, for, if

anything falls from the air, it has not time to sink into the jelly, but remains on the surface, and there forms its colonies, while the other organisms are, for the most part, in the interior of the jelly.

The third method of using nutrient jelly is for glass slide cultivations. For this purpose, either the glass plates before mentioned, or the ordinary microscopic slides are employed. They are sterilized in the usual manner, and are kept, after inoculation, on glass trays in glass vessels, arranged as for plate cultivations. The jelly is liquefied, poured out on the glass slides, and allowed to solidify. When solid, a platinum wire, bent at the end (see Fig. 18, B), and dipped in the material to be tested, is drawn lightly and rapidly over the surface. Generally, a number of slides can be thus prepared without dipping the wire a second time in the mixture. The result of this procedure is that, as the wire passes over the surface of the jelly, it shows the bacteria along its track, and if drawn sufficiently lightly, and rapidly, an organism will only be deposited here and there, especially in the later streaks. There are two advantages of this method. In the first place, it forms one plan of separating bacteria, for many of the colonies are pure cultivations, and are sufficiently distant from one another to enable one to take a pure cultivation from them. And, also, it enables one to test the purity of a cultivation more readily and easily than by means of a plate culture, for, by looking along the needle track under the microscope, one can readily see whether the growth is all of one kind, or whether more than one form is present. The second advantage is, that one can study the mode of spread of certain organisms on the surface of the jelly, and by this means much useful information may be obtained. From these cultures, the beautiful impress preparations previously mentioned are made.

Nutrient jelly is also very useful for cultivating some forms of anaërobes. For this purpose very long tubes are used, which are almost filled with jelly. This is rendered liquid, and then the material containing the supposed anaërobes is introduced and thoroughly shaken up with the jelly. If nothing but anaërobes are present, they will be seen to form colonies deep down in the tube, while a certain thickness of jelly at the upper part remains pure. If both aërobes and anaërobes are present, the former grow at the top and the latter at the bottom. By breaking the lower part of the tube and inoculating fresh tubes in the same manner from the colonies at that part, pure cultivations of the anaërobic organisms will ultimately be obtained.

*c. Agar-agar.* Of all culture materials the nutrient jelly is the most useful, but it has one serious defect, viz., it cannot be placed at the temperature of the human body without melting, when, of course, all the advantages of the solid culture are lost. Other materials which will remain solid at the higher temperature have been tried. Of these the chief is agar-agar, a material derived from certain plants (gracilaria

lichenoides). Of this material one to two per cent. is added to a meat infusion mixture, prepared in the same manner as for the gelatine. It is allowed to swell up for twenty-four hours in the ice-safe, and then dissolved in the steaming apparatus. It is extremely difficult material to prepare, and is never quite clear. Hueppe recommends the employment of two layers of filter paper in the funnel, and then a quantity of cotton-wool inside them. It is well in filtering the material to set the whole apparatus in the steaming apparatus, and keep it at 100° C. There is no danger of spoiling the solidity of the material by heating it too much. When prepared, it is introduced into and preserved in test-tubes in the same way as the gelatine material. As a rule, the test-tubes are allowed to solidify obliquely. Agar-agar may be used for test-tube, plate, or glass slide cultivations. In using it for plate cultivations great care must be taken not to kill the bacteria introduced, for the agar does not become fluid below 42° C. The best way is to have a vessel of water at 42° C. at hand. Melt the agar tube in the steamer, and then place it in this water until the temperature of the whole is 42° C. Then add the bacteria, shake up, and pour out rapidly on a glass plate.

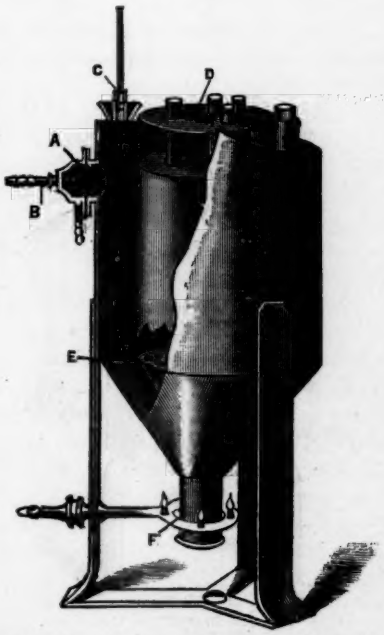
The temperature of 37° C. is maintained by means of an incubator, of which there are various forms. They all essentially consist of double-walled copper or tin vessels with either a lid or a door which is also double-walled. The space between the walls is filled with water. A thermometer passes through a hole in the top into the interior, and a gas regulator passes into the water to regulate the supply of gas to the burner. There are various kinds of gas regulators. The one most frequently employed is mercurial, of which Reichert's is the best form (Fig 21). It consists of a long tube, bulbous at the bottom, narrow in the middle, and wide at the top. To the narrow part at the side is attached a wider piece of glass tube, closed with metal, in which a screw works. The upper wider part is ground inside, and has a lateral tube, which is connected by India-rubber tubing with the gas-burner. Into the upper part is inserted a T-shaped piece of glass tubing, ground on the outer side of the upper part of the leg of the T, and tapering toward the end inserted into the long tube. This tubing is open at two ends; at the outer, or larger end, it is connected with the gas supply. At the lower end, the opening is comparatively small, while about the middle of the descending arm, and opposite the large exit from the long tube, is a minute hole. The bulb is filled with mercury, which passes up the narrow tube and fills the lateral tube on the narrow part. The transverse arm of the T-shaped top piece is connected by India-rubber tubing with the gas supply. The action of the apparatus is as follows: At first, gas flows freely into the

FIG. 21.

Reichert's gas regulator.

T-shaped piece, and thence through both holes into the upper chamber of the long tube, from which it passes on to the gas-burner through the lateral tube. As the water becomes warm, the mercury rises in the narrow tube until ultimately it gets into the upper dilated part, and closes up the lower and larger exit for the gas. Hence gas only passes to the burner through the minute lateral hole, and the flame diminishes. As the water again cools the mercury falls, until at length the lower hole of the tube is freed, and a full flow of gas again takes place. By this alternate rising and falling of the flame, the interior of the chamber is kept at a constant temperature. The regulation for a definite temperature (say 37° C.) is done in this way: The screw of the lateral tube is unscrewed as far as it will go. When the temperature has reached

FIG. 22.




Outline of d'Arsonval's incubator. A. India-rubber diaphragm. B, gas tube. C, plug and tube at the top. D, lid. E, tray on which cultures are placed. F, gas-burners.

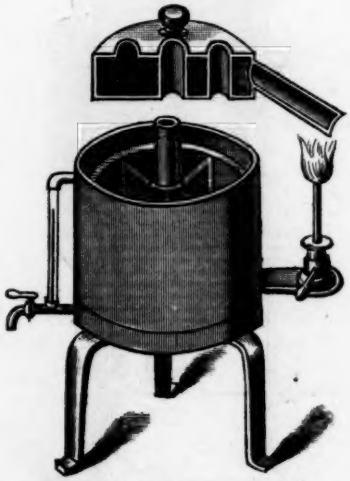
about 36° C. this screw is screwed in, and in doing so displaces the mercury and causes it to rise into the wide top. The lateral screw is screwed in until the lower exit for the gas is shut off, and the flame goes down. Should the small lateral hole still allow too much gas to escape,

it can be diminished by turning round the top piece until the hole is almost closed by the wall of the long tube. The most perfect incubator is the d'Arsonval machine made by Wiessnegg, of Paris, and outlined in Fig. 22. In it, the regulation occurs by the expansion of the water forcing out an India-rubber diaphragm (A) against the gas tube (B). In this case boiled water must be introduced into the machine, in order that the regulation may occur solely by expansion of water and not be complicated by expansion of gas.

Agar jelly has many disadvantages and hence is not, as a rule, much used except to maintain pure cultivations of microörganisms which only grow at the temperature of the body. It is difficult to make, never quite clear, difficult to utilize for plate cultivations, and the different bacteria do not grow with characteristically distinct features to such an extent as on gelatinized materials, and thus its diagnostic properties are less.

*d. Blood serum.* For the cultivation of tubercle bacilli and other organisms Koch has introduced coagulated blood serum. The blood of

FIG. 23.

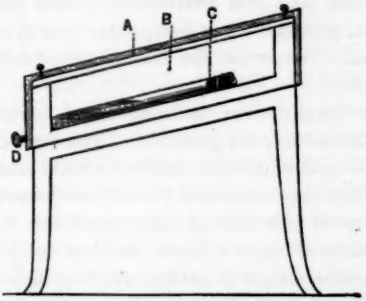


Koch's apparatus for sterilizing blood serum.

sheep, cattle, etc., is received into a long, narrow clean vessel and allowed to stand in the ice safe for twenty-four or thirty-six hours till the serum has separated. The clear serum is then drawn off and introduced into sterilized test-tubes. In his earlier method Koch placed these tubes in an apparatus (a sort of incubator, Fig. 23) regulated for a temperature of 58° C. to 60° C. They were kept in this for an hour at a time, and

this was repeated every day for six days in succession. At this temperature the serum does not solidify while all the adult bacteria are killed, and on Tyndall's principle the spores sprout in the interval between the heatings, and after two or three heatings all the bacteria are destroyed. At the end of six days the tubes were laid on the bottom of another water bath which could be placed obliquely (Fig. 24), and was provided

FIG. 24.




Koch's apparatus for solidifying blood serum. Lateral view. (After Hueppe.)

with a glass top through which the tubes could be seen. This top was covered with felt when not used. The temperature was then raised to from 65° C. to 70° C., at which the albumen coagulated, and when the serum was sufficiently firm the tubes were removed and placed in an incubator for two or three days to see if they were sterile. If the temperature is not raised above 70° C., the serum is fairly clear. (Of late, Koch has been content with simply solidifying the serum slowly at 65° C. at once without the preliminary exposures to 58° C. A certain number of tubes remain pure, but a considerable number are lost in this method.) When the serum has solidified and is allowed to cool, a little condensed steam runs down the sides of the tube and forms a drop of water at the lower part of the oblique surface of the blood serum. In order to be able to look at the growth with the microscope, the serum is sometimes solidified in little glass capsules provided with a glass cover and the bacteria are sown on this by stroking it with the platinum wire.

The blood serum is a very good cultivating medium for certain bacteria, more especially for tubercle bacilli, but it is troublesome to make and by no means the best medium for many other kinds. Hence its use is mainly limited to tubercle and glanders bacilli. After a few days in the incubator the upper part of the oblique surface of the blood serum dries up, and as the tubercle bacilli grow very slowly it is important to avoid this. This may be done by fixing a small India-rubber cap over the mouth of the tube, but this is dangerous because, if spores of fungi have fallen on the cotton-wool, they grow down through the plug, which

is, of course, quite moist under the cap, and fall on to and spoil the cultivation. To prevent this the top of the cotton-wool plug must be burned and washed with sublimate solution (1:1000), and the India-rubber cap must also be washed with the same solution before it is applied.

Various other modifications of these solid media have been used. Lōffler, in cultivating the diphtheritic bacillus, added to three parts of the blood serum one part of a neutralized filtered meat infusion, containing 1 per cent. peptone, 1 per cent. grape sugar, and 0.5 per cent. chloride of sodium. The serum was then sterilized and solidified in the manner just described.

*e. Pastes.* For fungi, pastes made of bread, crushed potato, horse dung, various fruits, etc., are very useful. These are made up to a thick paste, introduced into sterilized Erlenmeyer's flasks and sterilized in the usual manner. They are also useful for various bacteria.

Pure cultivations of the various microörganisms may either be obtained from mixtures of various kinds, such as one commonly finds in decomposing materials, etc., or if pathogenic they may be obtained from the affected organism. Most forms can be readily obtained from mixtures by means of gelatine or agar plate cultivations, or, if anaërobes, by means of the long tubes previously described, but in some cases where they grow slowly they either cannot be got at all, or must be obtained from some place where they already exist pure. Take, for example, the tubercle bacillus in sputum. The tubercle bacillus grows extremely slowly outside the body, while sputum contains large numbers of other bacteria which grow very rapidly, hence any attempt to obtain the tubercle bacillus pure by means of glass plate cultivations, or, indeed, in any other way as yet known, must prove a failure. They can, however, be obtained pure by introducing them into a soil in which they will grow and in which the other forms will not. Such a soil is the animal body, but it is quite possible that a similar artificial soil might be prepared, though this has not yet been done for tubercle. I have, however, in the case of certain parasitic skin diseases, more especially in *tinea tonsurans*, obtained pure cultivations of the pathogenic fungus by providing a soil which was unsuitable for the growth of the bacilli and micrococci which swarm on the hairs and yet permitted the growth of the fungus. Such a soil was obtained by adding small quantities of citric acid and extract of nux vomica to the ordinary nutrient jelly. In the case of other slow-growing and spore-bearing organisms, it might be possible to get them pure by adding an antiseptic to the mixture so as to kill the other bacteria, and then, washing the antiseptic away and sowing the material, the spores which would alone survive would grow. Or, it might be done by heating the mixture, as spores resist heat. In such a

case one must suppose that only spores of the particular organisms to be cultivated are present in the mixture.

In the case of pathogenic organisms it is best to get them from the body of the animal affected. If they are present in the blood this is easily done by killing the animal, tying it out on its back on a board, and washing the hair and skin over the thorax thoroughly with sublimate solution (1 : 500). A number of knives, scissors, and forceps are heated in the gas-flame and allowed to cool. With one the skin is divided; this knife is then heated and laid aside. With another the skin is dissected off the thorax. With a pair of scissors the ribs (in rabbits and guinea-pigs) are cut through, and with a fresh knife the sternum is dissected up. Again, with fresh scissors and forceps, the heart is seized and opened, and a pure platinum needle is dipped in the blood. The glass slide cultivations should be used in the first instance, for by this means, if there were more than one kind of organism present in the blood, or if any accidental contamination occurred, this would be at once detected by examining the line of growth, and pure cultivations could be obtained from a pure spot. If, on the other hand, a test-tube were at once inoculated, and an impurity were present, an impure cultivation would be obtained, and might lead to error, as indeed it has often done. Where the bacteria are not present in the blood but in the organs, the body is opened in the same manner; a slice is made into the organ, and a minute piece cut out with pure scissors, and sown on the surface of the gelatine or agar. It sometimes happens that the animal has been dead for some time before it is examined. In that case the outside of the organ may be covered with bacteria, and therefore it must be washed with sublimate solution, and a cut made almost across it with a pure knife. As the knife may have carried in bacteria from the outside, a fresh cut is made at right angles to this with a fresh knife, and to make assurance doubly sure, a third cut is made at right angles to the second, with a third knife. From the deeper part of this third cut small pieces are taken and used for plate cultivations, glass slide cultivations, etc. These are examples of the methods of procedure; they must be modified and adapted to the particular cases in question.

These methods of cultivation are also much used for the purpose of ascertaining the number and kinds of bacteria in water, earth, and air, and the results, though not quite exact, nevertheless give a great deal of useful information. The results are not as yet exact, because in the first instance we do not as yet know all the pathogenic organisms, and therefore bacteria may grow which we do not recognize as pathogenic. In the second place, all the pathogenic organisms may not grow on the soil employed or in the presence of oxygen, and yet these special forms may be present in large numbers in the material tested. And in the third place, they may grow so slowly that the culture material may be com-

pletely invaded by other forms before there has been time for the colonies of the pathogenic organism to become visible. In spite of these disadvantages, however, much information may be obtained as to the sanitary conditions of water and air in particular localities, for the presence of a large number of bacteria in a water indicates contamination and the existence of an amount of pabulum which ought not to be there.

The examination of earth is easily carried out by pounding up some of the earth to a fine dust in a sterilized mortar with a sterilized pestle. A minute quantity is then picked up on the point of a sterilized penknife and scattered over the surface of the nutrient jelly which has been poured out on a glass slide and allowed to solidify (glass slide cultivation). Under the microscope it will be seen that growth starts from the majority of the particles of earth, and if the earth has been pounded up sufficiently fine most of these centres of growth will be pure cultivations. Hueppe recommends that as anaërobes are always present in earth, some of the slides should be covered with a thin strip of mica. He also suggests that a quantitative analysis of earth may be made by mixing a certain weight of the powdered earth with a certain quantity of boiled water, and then testing this in the same manner as water. This method, however, can only yield imperfect results, as the earth quickly subsides, and it is not easy to distribute the bacteria equally through the water, many of them remaining adherent to the particles of earth. Koch has shown that the majority of the bacteria in earth are close to the surface, while deep down only spores and anaërobic forms are present.

In testing water one has to take into account both the numbers and the kinds of bacteria present. The water to be tested must be received into sterilized vessels and corked with a sterilized cork or glass stopper. A definite quantity is mixed with the nutrient jelly, and plate cultivations are made. As a rule, in the case of filtered water eight to sixteen minims may be added to three drachms of jelly without much risk of having too many colonies as a result; but with unfiltered water, or very impure water, much smaller quantities must be used, and indeed in some cases the water must be still further diluted by adding a known quantity to a given amount of boiled distilled water, and then using a certain quantity of the mixture for the cultivation. For ease in counting the colonies, when these are numerous, the glass plate is laid on a piece of black cardboard divided into small squares. By counting the number of colonies present in several of the squares, and by ascertaining the number of squares occupied by the jelly, a fairly accurate estimate of the numbers can be arrived at.

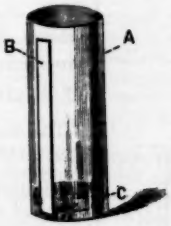
Air may be tested in various ways. By the older plans the air was aspirated over glycerine-covered surfaces, or through gun-cotton which was afterward dissolved in alcohol and ether and in other ways, and the dust so collected was subjected to microscopical investigation. The

results of this plan are practically *nil*, for it is impossible to recognize among the débris what are and what are not living organisms, nor what species are present. Hence, resort is now always had to cultivation experiments. Miquel, who has done most work on this subject, uses for the most part vessels of the shape shown in Fig. 25, containing cultivating fluids. A large number of these vessels are prepared and the pointed extremity, A, being broken off, a known quantity of air is drawn through each. The end A is again sealed and the bulbs set aside in a warm place (*e. g.*, an incubator) for development. A certain

Fig. 25.

Miquel's bulb for testing air by means of cultivation. (After Hueppe.)

Fig. 26.




Koch's apparatus for testing air. A, glass cylinder. B, strip of brass or tin. C, glass capsule for jelly.

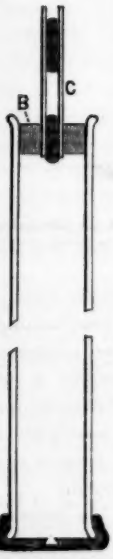
number of bulbs show development, a certain number remain pure. By counting the number in which development occurs and ascertaining the total quantity of air drawn through all the flasks Miquel estimates the number of bacteria in that amount of air. This method is totally untrustworthy and fallacious, for there is no certainty that development in each flask occurred from only one germ, there is no possibility even on microscopical examination of determining whether each is a pure cultivation or not, and one cannot tell what kinds are present.

Hueppe's method is a great improvement on this. He aspirates a definite quantity of air through a certain amount of culture fluid and then, shaking the flask well to distribute the bacteria equally through the fluid, he makes plate cultivations with known quantities of the fluid in nutrient jelly and agar, testing the mixture of air and culture fluid in the same way that water is tested.

Koch employed a glass cylinder six centimetres in diameter and eighteen centimetres high (Fig. 26, A), at the bottom of which is placed a flat glass capsule, C, to hold the jelly; this glass capsule can be easily lifted out of the cylinder by means of a piece of tin bent at right angles, B. The cylinder, capsule, and strip of tin are cleaned, the cylinder plugged with cotton-wool and the whole sterilized in the hot box. When the

vessel has cooled the cotton plug is removed, the capsule lifted to the margin of the cylinder, half filled with nutrient jelly (for this purpose Koch used a wheat infusion jelly), replaced, and the cylinder immediately replugged with the wool. Any organisms which fall in during these manipulations sink into the jelly and develop in its interior and not on the surface. When the jelly has set, the vessel is taken to the place where the air is to be tested, the plug removed and placed in a sterilized vessel and the cylinder left open for some time (even for some hours). Dust falls on to the jelly and after a sufficient length of time the plug is reinserted and the apparatus set aside for development. Growth occurs at various points on the surface of the jelly. This method gives a rough estimate of the kinds of organisms present in the air, but does not give any accurate account of the numbers present in a given quantity.

FIG. 27.




Tube used in Hesse's method of testing air. A, end covered with the caoutchouc caps. B, caoutchouc cork. C, glass tube.

Hesse has devised an elaborate apparatus for quantitative analysis, of which the following account may be given from his paper:

"The method devised by me, and employed in my investigations, consists essentially in drawing air through long tubes, the walls of which are covered with a layer of solidified nutrient jelly. The current of air is regulated and measured by means of an aspirator. From the number of colonies which develop on the jelly, and from the quantity of air employed, an accurate estimate is obtained of the number of germs in the air. This, however, gives only the number of germs which come in contact with the nutrient jelly, and which can grow under the conditions under which they are placed, such as at the temperature and on the nutrient soil employed."

APPARATUS.—For these experiments one requires glass tubing, nutrient jelly, and an aspirator.

"*Glass tubing.* The most convenient tubes to employ are about 70 cm. long and 3.5 cm. broad, having a capacity of about forty cubic inches. The tubes, the edges of which at each end are somewhat thickened or bent outward, are now prepared for the reception of the jelly; over one end a closely fitting caoutchouc cap is fastened, having a central hole of about one centimetre in diameter, and over this a second entire cap is placed; in this way the tube is completely closed at this end (Fig. 27, A). If one applies only a single cap over the end of the tube, as I did in my early experiments, there is a danger of detaching the jelly from the glass when the cap is removed, and, therefore, I used to cut out a small central hole in the cap before the commencement of the experiment; but by the use of two caps there is no danger of disturbance of the jelly by the removal of the outer cap.

"Into these tubes 50 c. cm. of fluid nutrient jelly are introduced by means of a pipette. This quantity is sufficient to cover the inner wall of the tube completely.

"Into the other end of the tube now containing the jelly a tightly fitting caoutchouc cork (Fig. 27, B) about 2 cm. in diameter is introduced. The

central part of this cork is perforated with a hole about 1 cm. in diameter, and through this passes a piece of glass tubing, C, about 10 cm. long and 1 cm. wide, and containing two plugs of cotton-wool. The plug nearest the large tube projects a little beyond the end of the small glass tube. This small piece of tubing is for the purpose of easily connecting the large tube with the aspirator, of equalizing the atmospheric pressure inside and outside the tube, and of acting as a filter for the air. The use of the two wool plugs is in order to meet requirements to be referred to later, which make it desirable to remove a part of the contents or to alter the position.

"The tubes, etc., are by no means free from micro-organisms even though the greatest care and cleanliness be observed. Although these accidental impurities could be recognized from the position in which the colonies appear (mostly in the substance of the gelatine), nevertheless, in consequence of their further development the result of the experiment would not be satisfactory; and further, the innermost wool plug, which, as will be later seen, is employed to control the accuracy of the experiment, would, on account of its contamination, be useless for that purpose; hence, it is necessary to destroy these organisms. This is most conveniently done by exposing the tube with the gelatine, etc., for one or two hours to a current of steam at or near 100° C. For this purpose I employ an apparatus similar to that described by Koch, Gaffky, and Löffler (*Mittheilungen aus d. Gesundheitsamtes*, p. 332). By means of it six tubes can be sterilized at one time. It consists of a cylindrical tin vessel about 1 metre high and 13 cm. wide, covered with a tin cap and surrounded by felt; this cylinder is fixed on the top of a tin vessel 20 cm. high and 13.5 cm. wide, filled with water.

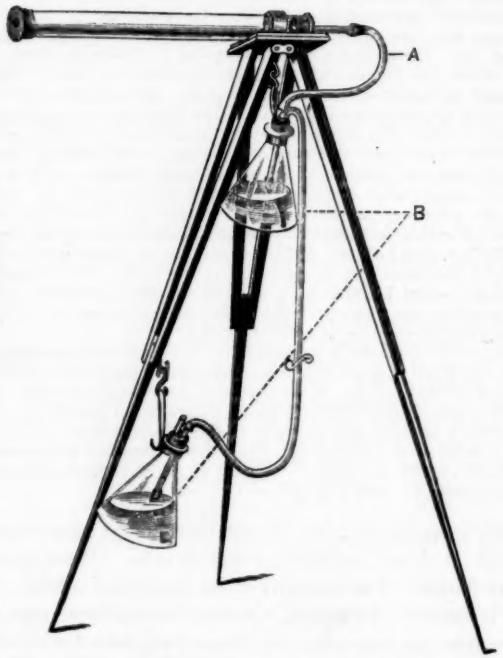
"After the tube has been removed from the steaming apparatus, and while the jelly is still fluid, it is moved in various directions under a cold water tap till the jelly solidifies. Thus an even coating over the whole tube is obtained, but in later experiments it was not found necessary to have the whole wall of the tube covered, as the organisms fell on the side on which the tube lay. The tube is now washed externally in a 1 per cent. corrosive sublimate solution, and fixed horizontally on a stand." (This stand is somewhat similar to that used in photography. See Fig. 28.)

By means of an elastic tube (A) attached to the narrow glass tubing the aspirator (B) is now connected with this tube. (Hesse generally uses two 10 litre flasks.) The one nearest the apparatus is filled with water, the other is empty. By setting a siphon arrangement into action the water flows from the upper into the lower flask, and the air which takes its place must pass through the apparatus. The rapidity of flow is easily regulated by a stopcock. When everything is ready, the outer caoutchouc cap over the end of the large tube is removed, and the water is made to flow from the upper to the lower flask at a moderate rate. It was found experimentally that all the dust was deposited in the large tube, unless the flow was very rapid. After a sufficient quantity of air has been drawn through, the aspirator is detached, the outer cap reapplied, and the tube laid horizontally at a suitable temperature (20° to 25° C.). In two or three days colonies are evident, and may then be counted and investigated.

None of these methods are quite satisfactory, and a good deal remains to be done in the way of improving this line of research. Probably by using both Hesse's and Hueppe's plans useful results would be obtained.

A very important application of these culture methods is to test the value of antiseptics. The older plans for testing antiseptics were either to add a certain quantity of the antiseptic to cultivating fluids and then inoculate with some putrid material, to see if growth occurred, or to add

FIG. 28.




Hesse's apparatus for testing air fixed on its stand and ready for use.
A, elastic tube connecting the glass tubing with the aspirator. B, the aspirator.

the antiseptic substance in a certain quantity to the mixture of bacteria, and then from this to inoculate a cultivating fluid. There are several objections to this plan. For example, as the special forms of bacteria tested were not known there was no certainty that the resulting growth was not accidental. Again, no account was taken of whether the bacteria acted on were in the spore or the adult condition.

Koch improved this method very much by using only known and well-characterized bacteria in his experiments, by ascertaining whether spores were present or not, and by employing solid culture media, and thus shutting out the confusion which might arise on account of accidental contamination. He also increased the certainty of his results by employing pathogenic bacteria, such as the anthrax bacillus, and after-

ward testing the result by inoculation of suitable animals. In the first place, he prepared a number of small pieces of cotton threads by putting them into a tube plugged with cotton-wool and sterilizing them. He then made a copious cultivation of the organisms or spores to be tested, soaked a number of the threads in the cultivation, laid them in a sterilized watch-glass, and placed them in a drying chamber over sulphuric acid. In the dry state non-spore-bearing bacteria may live three or four days; spores live a long time. He used cultivations of a large number of well-known organisms, such as Micrococcus prodigiosus for non-spore-bearing bacteria, and anthrax spores for spore-bearing organisms. The threads, when dry, were steeped for various lengths of time in solutions of the antiseptic of different strengths, then taken out and washed in boiled distilled water, or in alcohol and ether, and laid on potato, or on jelly poured out on glass slides. In a few days it was evident whether growth had occurred or not, and it was easy to determine if the growth resulted from an accidental contamination, or from the organisms tested. For, if the latter, the growth would start from the threads, and would also show the characteristics of the organism in question, such as the color of Micrococcus prodigiosus on potato, or the peculiar network growth of Bacillus anthracis on jelly.

In testing the effect of acids on the cholera bacillus,[1] I adopted a different plan, which, I think, has advantages over the other, in some cases. A cultivation of the organism in question in fluids is prepared, and a certain quantity of this cultivation is added to a certain quantity of a solution of known strength of the antiseptic to be tested, well mixed, and allowed to stand for a definite time. Tubes containing liquefied jelly are then taken, and a drop of the mixture of bacteria and antiseptic is added; they are then shaken up, and plate cultivations prepared. Control experiments are, of course, made to make sure that the amount of antiseptic thus added to the jelly is not sufficient to prevent growth. The jelly is already liquefied before the drop of the mixture is added to it, in order that the antiseptic may be at once diffused through the liquid, and not continue to act on the bacteria for a longer time than was intended.

### III. The Study of Bacteria in Relation to the Living Body.

In the case of all pathogenic organisms it is necessary for complete proof that they are the cause of a particular disease to show that, on their introduction into an animal of a species susceptible to the disease, they set up the disease in question. Experiments on animals are also required in the case of bacteria, in order to study the mode of infection and many other points in the natural history of the disease. The method

[1] See Report on the Cholera Bacillus, British Medical Journal, May, 1885.

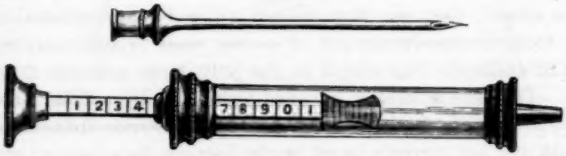
of infection varies in different diseases, but the following are the chief modes employed:

A. Cutaneous Inoculation.—Here a wound is made in the skin, but does not pass into the subcutaneous tissue. A portion of the body is selected which the animal cannot lick, and for this purpose the ear is generally chosen. The hair is shaved off, and the skin washed with sublimate solution (1 : 500), which is again removed with boiled water. The skin is then scratched with a sharp lancet, as in vaccination, and the infective material rubbed into the scratch. This mode of infection acts well with certain organisms, such as anthrax, mouse septicæmia, chicken cholera, etc.

B. Subcutaneous Inoculation.—Other organisms, such as the bacillus of malignant œdema, the tubercle bacillus, etc., must be introduced into a pocket in the subcutaneous tissue. The most convenient places for this pocket are, in guinea-pigs on the front or side of the abdomen, in rabbits at the base of the ear, in mice at the root of the tail. The skin is shaved and disinfected in the manner before described, and a small incision is then made through it with a pair of sharp scissors. With some blunt instrument a pouch is then formed in the subcutaneous tissue, and into this the material to be tested is introduced by means of a platinum wire, point of a knife, etc. After it is introduced the skin is rubbed over the place so as to diffuse the material, and, if necessary, the wound may be dressed with a bit of salicylic wool and collodion.

C. Subcutaneous Injection.—The back or the front of the abdomen, and the root of the ear or of the tail, are the situations most fre-

Fig. 29.

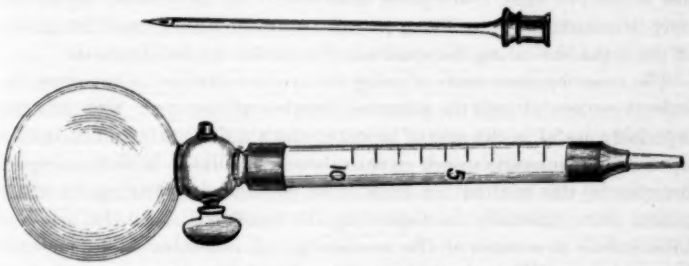



Koch's syringe for experiments on animals—old pattern.

quently selected. The skin is shaved and disinfected as before. The material is drawn up into a syringe of special construction, and the desired quantity is injected. The older form of syringe introduced by Koch (Fig. 29) consisted of a glass tube, on each end of which the thread of a screw is cut, and the metal fittings are thus screwed directly on to the glass. The piston is graduated, and the bulbous metal end is hollowed in the middle, and does not fill up the calibre of the tube; a sufficient amount of cotton or asbestos thread is wrapped around this end of the piston to make it fit the tube accurately. The washers are

made of thin pieces of cork. After each injection the cotton thread and the washers are removed and the syringe is washed. Before use, fresh thread and washers are arranged, and the whole is purified in the hot box. Of late, Koch has introduced a much simpler and more efficient form of syringe (Fig. 30). It consists of a straight piece of glass tubing

FIG. 30.



Koch's syringe for experiments on animals—new pattern.

graduated in tenths of a cubic centimetre, the outer side of each end being ground. Over each end metal fittings are attached; one taking the needle of the syringe, and the other having affixed to it an India-rubber ball with a hole at the top and a stopcock between it and the syringe. The tube and the lower metal attachment can be sterilized in the hot box or by heating them directly in the flame; the upper part does not require to be sterilized, as it does not come in contact with the injection fluid. By pressing the ball with the thumb over the hole, the contents of the tube are expelled, and the tube is filled by emptying the ball by pressure, and then allowing it to fill gradually by relaxing the ball, the end of the needle being dipped in the fluid. When sufficient material has been drawn up, the stopcock is turned. By means of these syringes, injections may be made not only into the subcutaneous tissue, but also into the cavities of the body (abdomen or pleura).

D. INTRAVENOUS INJECTIONS MAY BE MADE INTO THE JUGULAR VEIN OR INTO ONE OF THE AURAL VEINS.—If the injection is to be made into the jugular vein, the animal must be chloroformed and tied out on its back. The skin being shaved and disinfected, and the knives, forceps, etc., also disinfected, an incision is made over the jugular vein on one side, a double ligature passed round it, and between the two ligatures a small V-shaped incision is made into the vein, into which the nozzle of the canula is introduced and tied; the vein is also tied above. Injection may be made by a syringe through the canula, but I have always found it best when large quantities were introduced to use a burette, and let the fluid pass in slowly and without any force.

It is much simpler to inject into the aural vein. A vein is selected at the outer side of the edge of the ear, where the skin does not move over the vein, nor the vein over the cartilage. The skin is shaved and then disinfected, and then the needle of one of Koch's syringes is pushed directly into the vein and the material injected. It is easy to see if the needle is in the vein, and whether the injection flows properly or not.

E. The eye may be very conveniently used for inoculation, as it allows one to observe what takes place afterward. In some cases the cornea only is inoculated by pricking it with an infected needle and the spread of the organisms along the spaces in the cornea can be observed.

The most frequent mode of using the eye is, however, to introduce the infective material into the anterior chamber of the eye. This is more especially useful in the case of bacteria which grow slowly and do not set up much inflammation, such as the tubercle bacillus. In fact, in regard to tubercle, this method has been most valuable in clearing up many points, more especially in disproving the assertions as to the origin of tuberculosis as a result of the introduction of non-tuberculous material into rodents. When non-tuberculous material such as pieces of glass, cork, etc., were introduced into the abdominal cavity and the animal died afterward of tuberculosis, it might have been that the material set up the tuberculous process, or on the other hand that the occurrence of tuberculosis was independent of the operation. When tuberculous material is introduced into the anterior chamber of the eye of a rabbit, it remains there for some days without apparently causing any disturbance—in fact, gradually dwindling away, till in about twenty-one days an eruption of tubercle is noticed on the iris, and thence the disease spreads, affecting the whole eye and in most instances spreading to the body and setting up general tuberculosis. This iris tuberculosis always occurs. If a piece of cork or other non-tuberculous material is introduced into the anterior chamber of the eye, it is not followed by an iris tuberculosis, and should the animal afterward die of general tuberculosis (which occurs extremely rarely), it is thus known that the disease was accidental and independent of the operation. In introducing the material the eye is fixed and a small incision is made at the upper part of the cornea into the anterior chamber, care being taken as the knife is withdrawn that the iris does not prolapse. The material is then pushed into the anterior chamber through this opening by means of a blunt needle. Fluids may also be injected into the anterior chamber by Koch's syringe, the needle being pushed obliquely through the upper part of the cornea.

F. Inhalation.—In some cases it is necessary to test the effect of inhalation of virulent material in producing disease. In doing so the experimenter must, as a rule, guard against the danger to himself. The infective material may be furnished for inhalation either in the form of spray or as dust. In the case of spray the animals are placed in a box

into which the nozzle of a hand spray-producer projects. The retort of the spray contains the infective mixture, and the operator is separated from the spray by a long India-rubber tube. If necessary, he may shield himself by means of a respirator; but, as a rule, the box can be placed in the open air and at such a distance away that he is in no danger.

Spore-bearing organisms may be used in the form of dust, which may be either blown into the vessel containing the animal or placed on the floor of the vessel, which is then shaken to raise the dust.

G. Infection by the Food.—This mode of experimentation is used to test the possibility of infection from the intestine, and in carrying it out there are two points to be attended to: care must be taken, first, that infection does not occur from the mouth or throat; and, secondly, that the infective material is not destroyed in the stomach. At first the experiments were made by simply mixing the infective material with the food, but in these cases infection often occurred from the mouth and throat. To avoid this, Koch adopted the plan of taking two small slices of boiled potato, scooping out a small depression in each piece, filling this depression with the bacteria, placing the two slices in apposition so that the bacteria were enclosed in the potato, and pushing the piece of potato to the back of the tongue so that it was swallowed at once without being chewed.

As regards the second danger, it is only present in the case of non-spore-bearing bacteria. Spores are able to resist the action of the gastric juice, whereas adult forms are, as a rule, destroyed by it. In the case of the cholera bacillus, Koch has devised a plan in the case of guinea-pigs by which the bacilli escape the action of the gastric juice. He first neutralizes the contents of the stomach by introducing into it eighty minims of a five per cent. solution of carbonate of soda. Ten minutes later a culture of the cholera bacillus is injected through a stomach tube (catheter). Lest the bacteria, which thus escape the action of the gastric juice and enter the intestine alive, should pass too rapidly through the small intestine, he then injects a solution of opium into the abdominal cavity (sixteen minims of the tincture for every six ounces of the weight of the animal). Koch hopes that this plan will prove useful in testing other forms of bacteria.

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## THE ETIOLOGY AND MECHANISM OF ASTHMA.

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No subject in medicine has given rise to greater discussion or criticism than that included in the term "Asthma." It was indiscriminately applied by the older writers to dyspnœa arising from various causes, and

at the present time, although the majority confine the term to paroxysmal dyspnœa, accompanied by characteristic physical signs, still we find it used in a loose way to describe dyspnœa due to entirely different pathological conditions.

In this article I wish to confine the term to the paroxysmal dyspnœa which is always characterized by positive physical signs. I will exclude from consideration all other forms. Cardiac asthma due to a weakening of the heart, is not asthma; nor can we include the smothering of pure emphysema, although emphysema may be complicated with asthma. Suffocative attacks of bronchitis belong to the latter disease, although asthma may be also engrafted upon it and immeasurably increase the distress of the sufferer. In various diseases of the nervous system there is marked and paroxysmal dyspnœa, but the physical signs of asthma are always absent.

The older writers divided asthma into idiopathic or essential, and reflex. In the class of idiopathic asthmas were included all for which no reflex origin could be discovered; whilst in those classed as reflex, the point of irritation was mainly found in the bronchi and the mucous membrane of the gastro-enteric canal, the uterus, or the uterine appendages. The number of reflex cases was limited, and the large majority of cases were classified as idiopathic.

Modern investigations have proven that asthma of reflex origin is the most common, and at the present day it seems not improbable that those cases for which no local point of irritation can be discovered, and which seem idiopathic in character, will, by later investigators, be brought into the reflex class. Emotional asthma seems to be most certainly of the essential character; but when we consider it as analogous to vasomotor disturbances of the skin seen in emotional states, causing blushing or pallor, we may find a reflex origin through some of the senses.

Voltalini first drew attention to asthma dependent on the presence of nasal polypi, and showed that the removal of the polypi was followed by a cessation of the asthma. Later investigations have proven that it is not the polypi alone, but rather the peculiar condition of the nasal chamber in which the polypi are found that is the immediate cause of the asthmatic attack. Hack and John Mackenzie, of Baltimore, have especially drawn attention to the fact that a condition of congestion is at times present, and that the cavernous tissues of the turbinated bones become hyperæsthetic. They have endeavored to prove that the special sensitive areas are found either at the anterior or posterior extremities of the turbinated bones. It has now, however, been proven that the whole surface of the membrane is involved more or less in this sensitive area. In this sensitive condition, the presence of an irritant is capable of producing the asthmatic paroxysm. A polypus touching the sensitive area, retained secretions, dust, intense light, or anything capable

of producing an impression on the nasal mucous membrane will provoke the attack. Even a swollen condition of the mucous membrane allowing a lateral pressure between the septum and the cavernous bodies, seems to be a provoking cause. That a nasal polypus alone is not capable of producing asthma, is shown by a case in which I removed a polypus from the lower turbinated bone with complete cessation of the asthmatic symptoms, although the upper portion of the chamber was still filled with nasal polypi. The asthma subsequently returned on a recurrence of the lower polypus.

In the pharynx we find an immediate cause in the presence of hyperæsthetic, enlarged follicles. In a case of this character the asthma was modified by an application to the group of follicles, and disappeared after the destruction of the same.

In 1882 I presented to the American Laryngological Society a paper termed "Laryngeal Asthma." In this article I sought to prove the connection between a hyperæmic or inflamed condition of the larynx and the asthmatic paroxysm. I cited several cases where the asthmatic paroxysm had been modified or entirely removed by the application of an anæsthetic or astringent solution to the larynx. The sensitive area is especially the inter-arytenoidal space and the membrane over the arytenoid cartilages. Since then I have seen a large number of these cases, and will cite the following as illustrative:

Through a misplacement of bottles, I pencilled the larynx of a man suffering with a severe asthmatic paroxysm, with a fifty per cent. solution of carbolic acid. The application caused intense burning, and the patient was able to swallow with great difficulty for several days. The asthmatic paroxysm, however, *was instantly broken on the application of the brush*, and since then he has been entirely free from asthma. I could report many cases in which the spasm has been instantly modified or entirely broken by the application to the larynx of a mild solution of carbolized iodine, or the insufflation of morphia powder. From the success of this form of treatment, the immediate and at times almost instantaneous relief given, I feel justified in saying that the sensitive area of the larynx, in a large number of cases, is the site of localized irritation provoking the asthmatic attack. From a study of a large number of asthmatics, I am fully convinced that the local site of irritation in the greater number lies in the upper air-passages. Störck, Nothnagel, Longet, and Schiff, have demonstrated that the sensitive cough area is located in the inter-arytenoidal space, the posterior surface of the trachea, and at the bifurcation of the bronchi. Later investigators (Hack, Haring, John Mackenzie, Daly, and Roe) have added to these the surface of the lower and middle turbinated bones.

Many cases of so-called bronchial asthma have their site of irritation in the nares, in the larynx, and probably in the posterior surface of the

trachea, and the bifurcation of the bronchi. Cases of asthma caused by odors, the effluvia of animals, and the smell of flowers, or light, are due probably to a pathological condition of the nares. I am also inclined to believe that asthma due to emotional or psychical influence may in certain cases be due to the same cause. It is fully recognized that the so-called vasomotor catarrh, with turgescence and hyperæmia of the cavernous bodies, may be produced by mental impressions, the rose experiments of Dr. John Mackenzie being a striking example. It is also a well-known fact to laryngologists that a transient flushing or blushing of the mucous membrane takes place when the light of the reflector is thrown upon it. The following case is interesting as showing the dependence of a changed condition of the cavernous bodies on a psychical influence. In a patient of the St. Louis Post-Graduate Polyclinic the cavernous tissue of the nose was greatly swollen. I proposed to excise a portion of it. She demurred strongly, and when I insisted, became very much frightened: on looking again, I was astonished to find that the swollen tissue had become much paler, and had been reduced in size fully one-half. This was fully observed by members of the class.

Uterine asthma and peptic asthma, on which so much stress has been laid by Hyde Salter, may also have a possible connection with a certain condition of the upper air-passages. The coincidence of paroxysms of nervous dyspnœa with certain conditions of the uterus and its appendages, is well authenticated; but whether these paroxysms are real attacks of asthma or spells of nervous dyspnœa, in which we find rapid breathing with great intensity of the respiratory sounds, but no asthmatic râles, has not been so conclusively established.

Hyde Salter relates one case, reported by another physician, in which real asthmatic attacks occurred during pregnancy; and Engelmann, of St. Louis, has noted a case in which asthmatic attacks followed a retroflexed position of the uterus, and disappeared with the reposition of the organ; but in this case there is no record of the presence of asthmatic râles. Paroxysmal nervous dyspnœa is quite a frequent accompaniment of a disturbed condition of the nervous system. It is seen in hysteria, neurasthenia, and spinal irritation; it is seen in connection with disorders of the uterus or its appendages, and also in cases of impoverishment of the blood or blood-poisoning. Resembling true asthma in its paroxysmal attacks, it is, however, a distinctly different disorder. The dyspnœa is rather a rapid panting than the labored breathing of asthma; the respiratory sounds are simply intensified normal sounds, and the asthmatic râles are absent.

That asthma occurs at many of the critical periods of female life is certainly true. In regard to pregnancy, I have seen two cases in which the asthma disappeared with conception, and has not since returned.

Both of these patients were asthmatics of long standing. It is in these cases of uterine asthma that we can find often a possible nasal origin for the attacks. The connection between the condition of the cavernous bodies and uterine changes is very marked. Many women at the menstrual epoch have vasomotor catarrh, with great turgescence of the cavernous bodies and the mucous membrane. This condition in itself has been shown to be a sufficient cause for the attack, irrespective of the pathological condition of the uterus. The peptic asthma, on which so much stress is laid by Hyde Salter, may be fully explained by referring the irritation to the larynx. Gastric pharyngitis and gastric laryngitis are recognized forms of throat disease. They are dependent upon functional gastric disturbance, with the production of fermentation and acid secretions. In the peptic asthma quoted by Hyde Salter, the paroxysms occurred during the end of the digestive process, showing that the mere presence of food is not sufficient to cause the attack. The majority of asthmatics are dyspeptics, and it is possible that these cases were subject to a gastric laryngitis, in which the sensitive area of the larynx was involved. A similar condition is found to exist in so-called stomach cough. Although the local seat of irritation seems to be, in the majority of cases, in the upper air-passages, it is probable that a disordered condition of other organs exerts a positive influence in provoking the attack. As this is true in other nerve disorders, as migraine, epilepsy, and neuralgia, it is equally probable in asthma. For example, in a person with a disposition to asthma, the attacks may only attain the degree of the first stage, and give rise to scarcely noticeable symptoms. When, however, an increased irritation is added, as would occur through a disorder of the gastro-enteric canal or uterine disease, this added element would be sufficient to increase the irritation, and the first stage would grow into the second with the appearance of all the well-known asthmatic symptoms. A similar condition is found in neurotic palpitations occurring in a heart weakened by anæmia, where a torpid liver would provoke a disturbance, which, in a normal condition of the secretions, would be absent.

All writers on asthma have noticed the great difference in the severity of the paroxysms not only in different individuals, but even in the same individual at different times. Walsh has even assumed two forms of the disorder, one seemingly dependent on a spasmodic and the other on a paralytic condition of the bronchial muscles. If the asthmatic be closely studied during the paroxysm, we shall find a positive and characteristic connection existing between the severity of the attack and certain physical signs in the lungs. We can clearly divide the paroxysms into three stages, each stage characterized by positive physical signs, and with each stage a certain increasing degree of the severity of the symptom is noted.

The first stage may be called the state of

### Inspiratory Dyspnœa.

On examination we find the percussion sound unaltered; on auscultation the *inspiratory sound of the vesicular murmur is replaced by a high-pitched, prolonged blowing sound.* The expiratory sound may be absent or unchanged. This blowing inspiration is evidently *a blowing râle*, and it is caused by a cylindrical narrowing of the lumen of the bronchi, not sufficient to cause the sibilant or whistling râles. It is pathognomonic of the first stage of uncomplicated asthma, and differs from the rough inspiratory murmur of bronchitis or the intensified inspiration of the exaggerated respiration such as is heard in compensatory breathing or in the nervous dyspnœa of hysteria or blood poisoning.

When asthma is complicated with bronchitis, this inspiratory blowing sound loses, in a measure, its distinctive quality and becomes rougher and of lower pitch. When emphysema is present, the blowing quality of the sound is less marked, and it becomes much weakened and in some cases is absent.

The symptoms of the first stage are often slight; at times wanting. In some a slight tightness of the chest is experienced; in others a slight dyspnœa is felt on exertion; a paroxysmal cough most marked in the early morning hours is sometimes the only symptom.

The second stage may be called the stage of

### Expiratory Dyspnœa.

It presents the physical signs usually recognized as characteristic of the asthmatic paroxysm. Percussion gives an increased resonance. On auscultation, a prolonged expiration is heard. Both expiration and inspiration may be covered by the sibilant and sonorous râles. In certain cases small moist râles of a liquid character are heard over limited portions of the chest. The symptoms of the second stage are those usually associated with the asthmatic paroxysms; the sense of oppression, the dyspnœa, and the slow, labored breathing are marked. The thorax heaves with each inspiration and the accessory muscles of respiration are brought into action, the patient is unable to lie down, but sits or moves in a fixed position, with raised shoulders and head projected forward. The face is livid and the alæ nasi dilated.

The third stage may be called the

### Stage of Orthopnœa.

Percussion gives a deep, drum-like resonance, showing the extreme distention of the vesicles. *On auscultation a short inspiratory whiff is heard, and the expiratory sound is inaudible.* The inspiratory whiff is most apparent over the larger bronchi. The symptoms of the third

stage of asthma present a picture of the most supreme distress and agony. The patient stands with the hands resting on some fixed point of support, and the entire energy of the body is given up to the struggle for air. The true respiratory muscles seem to be completely inactive, and breathing is carried on entirely by the accessory muscles of respiration. The thorax is fully distended with little perceptible movement; the face becomes dusky, covered with perspiration—in strong contrast with the cold extremities; a sense of constriction is experienced around the body over the diaphragm.

These three stages are evidently produced by the varying and gradually lessening calibre of the bronchial tubes. In the first stage the calibre of the tubes is not sufficiently narrowed to produce the whistling râles. The inspiratory blowing râle heard in this stage is due to the moderate narrowing of the bronchi. A normal inspiration is the result of atmospheric pressure; the thorax is enlarged by the action of the thoracic muscles and the diaphragm, and the lungs are distended by the atmospheric pressure. The expiration is mainly performed by the lung vesicles. In the first stage the calibre of the bronchi is narrowed, but the walls of the vesicles remain intact and are normal: hence the expiratory sound is normal, but the inspiration assumes the peculiar high-pitched blowing found in this stage. In the second stage portions of the bronchi are narrowed to such a degree that the respiratory sounds assume the form of râles—the sonorous and whistling. The vesicles are distended through imperfect ventilation of the lungs and the energy of the stretched, elastic fibres is impaired. The result of this is a prolonged and labored expiration, in which the expiratory sound is formed by the sonorous and sibilant râles. In the third stage the lumen of the bronchi is reduced to a minute canal. The vesicles are distended to their utmost capacity; the bronchial mucous membrane is greatly swollen, and the diaphragm is either in a state of spasm or fixed and crowded by the over-distended lung. The greater portion of the air within the lung is residual air and there is no current except in the bronchi of larger calibre; aëration is performed slowly by the interchange of gases in this portion of the lung. There is no action of the vesicles or the diaphragm, and no expiration is heard; the inspiratory sound is produced by the passage of air through the glottis and larger bronchi. In some cases we can also see transition periods in which the first stage is verging into the second—shown by the presence of inspiration commencing with a blowing râle and ending in a sibilant; or with a blowing râle on inspiration and a sibilant or sonorous râle on expiration. The transition of the second to the third stage is seen in shortened expiratory râles which disappear completely as it lapses into the full third stage.

These different stages of asthma occur in the same individual at

different times, although a certain similarity of type is apt to occur in different individuals. That they are simply stages of the same process, and that the varying physical sounds are all due to a narrowing of the bronchi, are fully proven by the effects of therapeutic efforts. For example, the inhalation of nitrite of amyl, or an application of carbolate of iodine to the larynx, will often instantly change the inspiratory whiff of the third stage to the prolonged expiration with the sibilant and sonorous râles of the second. This change is at once realized by the patient in a loosening of the constriction of the chest, and greater comfort and freedom of breathing. We can also, through the same means, produce a change from the whistling râles of the labored expiration of the second stage to the blowing râles of the first. When the asthmatic is subjected to some additional source of irritation, we find the increased distress of the patient explained by the change from the first to the second stage, or the second to the third. Although the asthmatic paroxysm is essentially due to a bronchial obstruction, we find it quite frequently interchangeable, and at times complicated with spasm of the glottis and spasm of the diaphragm. In one case, of a lady sixty years of age, I have seen a pure asthmatic spasm subside and followed in a few days by a distinct spasm of the glottis, with entire absence of asthmatic breathing; and again, in her next attack, glottic and bronchial spasm were absent, and spasm of the diaphragm was present. At this time a feeling of intense constriction was felt over the diaphragm, and the breathing was almost entirely superior costal, with a complete absence of the asthmatic râles. The sense of constriction in the upper part of the chest seen in the asthmatic, was wanting. In another case I have seen a true asthmatic paroxysm complicated, and at times synchronous, with spasm of the glottis. In this case the asthma disappeared, but the man died suddenly from glottic spasm. These conditions cannot be considered in reality as part of asthma, although often complicating it. They bear the same relation to the asthmatic paroxysm as exists in many other nerve disorders. For example, migraine, epilepsy, neuralgia, and insanity, are all interchangeable with asthma, and in families showing a disposition to nerve disorders they may be found in different individuals. That bronchitis and emphysema ultimately arise as sequelæ of asthma, is clearly probable, as the continued disturbance of the normal condition of the bronchial mucous membrane is apt to produce and incite pathological changes; and the great and frequent disturbance of the elastic fibres of the vesicle can only result in weakening and loss of tone. The right ventricle must also frequently suffer, undergoing dilatation and hypertrophy, as the great distention of the walls of the vesicles must seriously interfere with the normal pulmonary circulation.

The mechanism by which the asthmatic paroxysm is caused, has always been the subject of dispute and controversy. Laennec, followed

by Andral, ascribed it to spasm of the circular fibres of the bronchi, causing cylindrical narrowing of these tubes. This may be said to be the prevailing doctrine at the present day, and it has been endorsed by many of the most eminent authorities in medicine; among these may be mentioned the names of C. J. B. Williams, Bergson, Hyde Salter, Trousseau, and Biermer. Rieseisen having demonstrated the existence of the circular fibres of the bronchi, others have sought to prove their capability of contraction under certain stimuli. Longet and Volkmann especially claim to have accomplished this by means of electro-stimulation of the vagus, but this result has not been produced when the experiments have been carried out by others. The theory of bronchial spasm as an element of the asthmatic paroxysm, has been warmly disputed. Budd rejected the idea, and he has been followed by Wintrich, Bamberger, Germain Sée, and others. Duchenne having demonstrated that faradization of the phrenic nerve caused spasm of the diaphragm, was inclined to consider this as an essential element of the paroxysm. In this he was supported by Wintrich and Bamberger. Traube denied the nervous origin of asthma, and ascribed the dyspnœa to the fluctionary hyperæmia of the bronchial mucous membrane. He supposed certain persons to have a certain predisposition to asthma, and that the predisposition consisted in a deficiency of the elastic fibre in the lung, allowing a ready distention of the bloodvessels, and thus allowing a ready swelling of the bronchial mucous membrane. Sanderson ascribes the paroxysm to a dependency on a change in the respiratory function of the vocal cords. He believes this to be an extreme relaxation of the vocal cords during slumber, and a narrowing of the rima glottidis. Beau considers asthma to be a bronchial catarrh with viscid secretions. Leyden ascribes the attack to be due to the presence in the bronchi of a peculiar kind of octahedral crystals produced from white blood-corpuscles, which irritate the pulmonary filaments of the vagus, and provoke the bronchial spasm. Weber considers asthma to be a vasomotor neurosis in which an acute catarrh with a dilatation of the vessels of the bronchial mucous membrane is produced. In this theory he has been followed by Störck, who asserts the existence of tracheal congestion as shown by the laryngoscopic mirror. Lately, Sir Andrew Clark has described a condition of the bronchial mucous membrane simulating the wheals of urticaria on the skin, and has sought to prove this to be a pathological condition of the disorder.

That the theory of spasm of the bronchial muscles is the prevailing one must be admitted, but it stands more in the light of medical tradition than proven fact. The experiments made to prove the contractibility of the bronchial fibres by irritation of the vagus have been conflicting, and the untenability of the theory has been notably disproved, both on clinical and experimental grounds, by Wintrich and Germain

Sée. The fact of the circular fibres being of the unstriped variety, in which the contraction must be slow and gradual, absolutely negatives their coöperation in the sudden and transient narrowing necessary to produce the phenomena of asthma. The office of the bronchial muscles seems more probably to be that of supporting muscles, regulating and supporting the bronchi against atmospheric pressure and undue violence of exertion. The recent experiments of Riegel and Edinger have shown conclusively that irritation of the vagus does not provoke a bronchial spasm, but rather a spasm of the diaphragm; Biermer, the earnest defender of the theory of bronchial contractibility, is forced to say that although stimulation of the vagus may not produce marked contractions of the bronchial muscles, we have not yet found the proper experiments necessary to prove it, and possibly the stimulation must be to the pulmonary sympathetic plexus rather than to the vagus. That spasm of the glottis and spasm of the diaphragm occur in the asthmatic cannot be denied by any one who has made a study of the disorder; the symptoms of those conditions are so marked, and their occurrence so frequent, that they cannot be overlooked; but that they are part of the essential nature of asthma is not true, as we find many cases of asthma in which they are wanting. Spasm of the diaphragm can never produce the mechanical râles always found in asthma, although in certain cases it may play an important part in producing the great distention of lung vesicles seen in the later stage of the disease. The theory of Weber, that the paroxysm is due to vasomotor turgescence or dilatation of the mucous membrane of the bronchi, finds complete support in the clinical picture of asthma: the transient and rapid variations of the physical sounds, the presence of the dry and moist râles, and the acute distention of the lungs seen in pronounced attacks of the disease. This theory, however, is directly contradictory to the acknowledged physiological effect of the drugs which are generally recognized as most useful in allaying the paroxysm; the nitrites, chloral, and morphia are all known as relaxants and anti-spasmodics, and their use could only increase the distress if the dyspnœa was due to a vasomotor dilatation of the vessels of the bronchial mucous membrane. The action of chloral and morphine could be explained by their effect on the nerve-centres; but the efficacy of the nitrites finds here no support. The physiological action of venous blood and carbonic acid on the arterioles and their actual effect in asthma negative the existence of a vasomotor dilatation of the arterioles as a cause of the paroxysm. Ludwig and Severini have shown that venous blood, when circulated for a length of time, causes the vessels to dilate, and that a large amount of carbonic acid in the blood causes a dilatation of the vessels. The natural sequence of an asthmatic paroxysm is extreme venosity of the blood, with an accumulation of carbonic acid through its imperfect aëration. These

conditions in reality existing to such an extreme degree in the asthmatic paroxysm, would simply increase the paroxysm if the disturbance were due to vasomotor paralysis of the vessels; whilst, in fact, we find them to be essential elements in the natural cessation of the attack.

In a paper read before the American Laryngological Society, at Detroit, in 1885, I described a condition of the nasal mucous membrane seen in certain patients. This condition is characterized by pallor, swelling, and an œdematous condition of the membrane. When irritated as by the touch of a probe or any other irritant, the swelling is increased and a profuse, thin or watery secretion is poured out. This condition promptly subsides after the inhalation of nitrite of amyl, ether, or the instillation of atropine or morphia; but remains unchanged on the application of cocaine. These cases occurred in persons of a marked nervo-vascular temperament, and in whom functional nerve disturbances were common. The existence of pallor, more or less marked, and a marked œdematous condition of the mucous membrane, distinguish this condition from that ordinarily seen in vasomotor catarrh. In the latter condition there is hyperæmia with dilatation of the vessels; but in the former the pallor completely negatives the idea of a dilated condition of the vessels, and the opposite condition must exist. The action of the drugs indicated in these cases rather a spasm of the arterioles, and I have chosen to consider the disturbance of the nasal membrane to be due to a vasomotor spasm of the arterioles of the membrane. The following case, in which this peculiar condition was the accompaniment of a facial neuralgia, is presented as a perfect type of the condition:

A. M., merchant, florid, stout, about forty-five years of age, was brought to me, complaining of facial neuralgia of the left side and great obstruction in the nostril of that side. He said that this obstruction of the nostril had occurred simultaneously with the attack of the neuralgia; that at times it was so great as completely to close the canal. There was a profuse discharge of a thin, limpid fluid, which was greatly increased on the application of any irritant, such as dust, or the touch of the probe. These same agents also had a marked effect in increasing the swelling of the cavernous tissue. On inspection the right nostril was found normal; the left nostril was almost completely occluded by the pallid membrane of the swollen cavernous bodies, almost as pale as that seen in a corpse. It presented an œdematous, boggy appearance, as if the whole tissue was saturated with secretion, and on any irritation this was poured out in a profuse discharge of a thin, limpid character. This entirely subsided with a subsidence of the facial neuralgia.

A study of these cases led me to surmise that possibly an analogous condition may exist in the mucous membrane of the bronchi during asthmatic attacks. I examined a large number of asthmatics during the paroxysm with the laryngoscope mirror, and found that during the paroxysms the mucous membrane of the pharynx, including the uvula, presented a similar pallid, œdematous appearance; that the membranes

of the larynx and trachea appeared paler and more swollen than normal, but not so œdematous as that of the pharynx. When portions of the membrane were inflamed, as is common in asthma, the inflamed area presented more the pale red of an intensely anæmic or phthisical subject than the rosy red of ordinary hyperæmia or inflammation. This is in direct contradiction to the observation of Störck, who claims to have found the larynx and trachea congested during the attack. If these conditions can be seen to exist during the asthmatic paroxysms in the upper air-passages as far as inspection is possible, I think we are fully justifiable in reasoning that an analogous condition exists in the bronchi. The normal functional differences between the mucous membrane of the bronchi and that of the upper air-passages would somewhat change the picture, more especially as the excessive glandular secretions would be greatly diminished in quantity or even wanting. A similar condition to this we find existing in the sympathico-tonica type of migraine (Eulenburg), with vascular spasm and diminished supply of blood in the brain.

I would, then, consider asthma to be a disorder of vascular irritability; that the paroxysm is directly due to a partial occlusion or cylindrical narrowing of the lumen of the bronchi through the swelling of the bronchial mucous membrane; that this swelling is caused by a vasomotor spasm of the arterioles with a saturation of the tissues by the liquor sanguinis; this condition is accompanied by a general high blood pressure.

With this theory we find a complete explanation of all the physical signs of asthma. We see the possibility of the rapid changes of physical signs observed during the paroxysms, and we have in its support the physiological action of all the drugs which experience proves to be of value in allaying the paroxysm—the nitrite of amyl, morphia, chloral, lobelia, and iodide of potash in their action allay the spasm at the same time that they tend to reduce general blood pressure; whilst drugs like the bromides prove of little value in breaking the paroxysms when once in force, although they are serviceable in preventing a recurrence.

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## ENVIRONMENT IN ITS RELATION TO THE PROGRESS OF BACTERIAL INVASION IN TUBERCULOSIS.

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Though much light has been thrown of late on the etiology of tuberculosis by the labors of Koch, Baumgarten, Weigert, and others, the conditions which lead to tubercular infection are yet shrouded in

mystery, and many clinical facts and teachings remain seemingly at variance with the new doctrine. The older clinical medicine on one side points to unhygienic surroundings, malnutrition, struma, defect of anatomical structure, and heredity as the main causes of tubercular disease, while experimental research brings evidence not easily to be thrust aside to support its claim to have discovered in the bacillus tuberculosis the virus which is essential to the production of this fatal class of maladies.

The acknowledged causes of consumption may conveniently be divided into those operating before, and after birth, the former coming under the general heading of heredity, the latter of environment. The problems of heredity are most complex and reach, as yet, far into the domain of hypothesis; but the effect of environment in its relation to bacillary invasion may more readily be subjected to study. So much do certain conditions of air, light, food, and especially habitation influence the etiological history of the development of consumption that a prediction as to the prevalence of the disease in any given locality may often be based on a thorough knowledge of these conditions. Drs. Bowditch and Pepper[1] in this country, and Dr. Buchman[2] in England, have done most valuable work in this direction and the results of their labors alone seem sufficient to establish the fact that environment is a most potent factor in the causation of tuberculosis. What, however, are its relations, if any, to the development and progress of bacillary invasion? To determine how far extremes of environment favor or arrest the progress of germ infection and to what degree they are mutually or independently concerned in the causation of tuberculosis, has been the object of this research and an answer to the three following questions sought.

*First.* What results ensue when both bacillary infection and unhygienic surroundings are made to coexist in tuberculosis?

*Second.* Are unhygienic surroundings, when every known precaution has been taken to exclude the bacillus, sufficient of themselves to bring about the disease?

*Third.* Is bacillary infection invariably progressive in animals placed under the best conditions of environment attainable?

EXPERIMENTS.—Fifteen rabbits were made use of and divided in three lots, each set of animals being placed under conditions best adapted to answer in the results noted the three questions already referred to.

*Experiment No.* 1. Five rabbits were inoculated in the right lung and in the left side of the neck with five minims of sterilized water in which was suspended a sufficient quantity of a pure culture (third generation) of the tubercle bacillus to render the liquid quite perceptibly turbid.

[1] New York Medical Journal, Dec. 4, 1886.

[2] Ninth and Tenth Report, Medical Officer, Privy Council, 65–67.

The needle of the Koch's inoculating syringe was inserted subcutaneously on the left side of the neck and in the third intercostal space to a depth of thirty millimetres on the right side. These animals were then confined in a small box and put in a dark cellar. They were thus deprived of light, fresh air, and exercise, and were also stinted in the quantity of food given them while being themselves artificially infected with the tubercle bacillus.

*Experiment No.* 2. Five healthy rabbits were placed under the following conditions: A fresh hole about ten feet deep was dug in the middle of a field, and the animals having been confined in a small box with high sides but no top, were lowered to the bottom of this pit, the mouth of which was then covered with boards and fresh earth. Through this covering a small trap door was cut which was only opened long enough each day to allow of the food, consisting of a small potato to each rabbit, being thrown to the animals. So damp was the ground at the bottom of this pit that the box in which the rabbits were confined was constantly wet. Thus these animals were deprived of light, fresh air, and exercise, furnished with but a scanty supply of food while breathing a chill and damp atmosphere, though free from disease themselves and removed as far as possible from any accidental source of bacterial infection.

*Experiment No.* 3. Five rabbits having been inoculated in precisely the same manner as the animals in the first experiment, were at once turned loose on a small island in June, 1886. It would be difficult to imagine conditions better suited to stimulate the vitality of these animals to the highest point than were here provided. They lived all the time in the sunshine and fresh air, and soon acquired the habit of constant motion so common in wild animals. The grass and green shrubs on the island afforded all the fresh food necessary and in addition they were daily provided with an abundant supply of vegetables. Thus, while artificially infected themselves they were placed in the midst of conditions well adapted to stimulate their vital powers to the highest point attainable.

Results.—*Experiment No.* 1. Four of the inoculated rabbits confined in the cellar died within three months: in all of them the injected lung was extensively diseased; the other lung and the bronchial glands being also more or less involved and tubercles in various stages, but sufficiently advanced to be macroscopical, were found in the pleura, peritoneum, spleen, and liver; from these lesions pure cultures of tubercle bacilli were obtained. The fifth rabbit survived and was killed four months after injection; at the autopsy the right lung was found solidified and shrivelled, the upper portion being almost entirely destroyed, while a bronchial gland as large as a hazelnut, filled with creamy pus, occupied the right chest; tubercles, which in many places had become cheesy, studded the upper portion of the left lung. The other organs were healthy.

*Experiment No.* 2. The five uninoculated and healthy rabbits placed in the damp pit were all living at the end of four months. They were emaciated and their coats were rough, but they still seemed about as active as at the beginning of the experiment. They were all killed within a few days of each other, but a careful examination of their organs revealed nothing abnormal in any of them.

*Experiment No.* 3. One of the five rabbits which were allowed to run at large died just one month after inoculation. The lower portion of the lung was solidified, the bronchial glands enlarged, as well as the axillary glands on the left side, and a few tubercles were made out in the spleen. The left lung and all the other organs were sound. The four other rabbits remained apparently in perfect health, and so active had they become that two of them could only be captured with the aid of a gun. All four animals were killed at the beginning of November, or four months after inoculation. They were loaded with adipose tissue and their flesh was so firm and red as to be in striking contrast to the blanched and flabby muscles of the other rabbits previously examined. All the organs were healthy and even the points of inoculation could not be made out.

A review of the evidence afforded by these experiments confirms the view that the production of tuberculosis is a most complex problem and one in which many elements besides the bacillus enter. How surely and rapidly this microbe accomplishes its work when the normal resisting power of the system is for any cause lowered, is well shown by the manner in which the first lot of animals succumbed. Localized tuberculosis was in every instance but one quickly followed by general systemic infection and death. That animals kept in most laboratories are frequently confined under conditions of air, light, and overcrowding, which may materially influence the results of investigations in a disease of the nature of tuberculosis, can hardly be denied and should be kept in view.

Necessarily imperfect so far as affording protection from bacillary infection as were the conditions under which the animals in Experiment No. 2 were placed, the results obtained seem to indicate that unfavorable environment and the consequent malnutrition which invariably follows existence amidst unhygienic surroundings are not sufficient of themselves to cause tuberculosis. The fate of the animals allowed to run wild is most instructive, inasmuch as it seems to indicate that in a great majority of instances resistance to the invasion of so deadly a germ as the tubercle bacillus is possible in the artificially produced disease, provided the vital and nutritive processes of the animal are stimulated to the highest possible state of activity.

In estimating, however, the power of environment in rendering these rabbits insusceptible to the disease, it must be remembered that in them the tuberculosis was an artificial one, produced in previously sound animals, and not the culmination, as in the spontaneous disease in man and animals of many debilitating causes, acting often through long periods of time, and impairing the resisting power of the system to such a degree as to allow of spontaneous infection. That incipient phthisis is frequently recovered from is demonstrated by the results of autopsies on individuals dying from other causes, and by a long list of clinical observations. The interesting cases of tubercular inoculation in circum-

cised children recently reported by Lehman,[1] furnish proof that so large a number as thirty per cent. of recoveries may occur, after artificial inoculation, even when profound systemic infection has existed. Experimental research has already furnished proof of the potency of environment in determining microbic diseases in animals otherwise insusceptible. Thus, Pasteur[2] succeeded in killing hens with anthrax, after reducing their naturally high temperature by keeping them partially immersed in cold water, though these birds in their usual surroundings are proof against this microbe. Gibier[3] gave the same disease to fish, and Metzchinkoff[4] to frogs, by warming the water in which they lived, after failing to infect them in their natural environment. Wild animals and game birds, which, in their wild state, are never known to die of tuberculosis, rapidly succumb to the malady when placed in confinement, and the North American Indians, among whom phthisis is practically unknown while living a savage life, are decimated by consumption when placed under the trying restrictions of a more civilized mode of existence.

If, therefore, environment is so potent a factor in determining bacterial infection, are its effects on the future course of the malady when it has occurred to be disregarded? How potent may be its influence is demonstrated by the widely differing results obtained in the inoculated rabbits allowed to run wild, and those confined amidst unhygienic surroundings. That it is not, however, more than a predisposing cause of the disease, seems indicated by the survival of the animals in Experiment No. 2, which, though they were deprived of fresh air, light, and exercise, and stinted in the amount and quality of their food for over three months, developed no organic lesions. Thus it would seem that the local mischief having been produced, the future type assumed by the morbid processes, and even the ultimate result, is greatly dependent on the resisting power evinced by the individual, which may be computed as the sum total of all the conditions which affect individual vitality through heredity and environment.

The two ultimate elements in this struggle for existence are the bacillus and the cell. Though in its infancy, bacteriology already points to the cell as an active factor in resisting the progress of bacterial invasion. Metzchinkoff[5] saw the lymph cells of the frog englobe and destroy anthrax bacilli, and Wyssokowitsch[6] found the microbes which he injected in the circulation of animals, taken up by the endothelial cells lining the capillaries of various organs, where they finally became destroyed. Suppuration is now being looked upon by some as a con-

[1] Deutsch. med. Wochensch., 1886, Nos. 9-13.
[2] Les Bacteries, Cornil and Babes, page 582.
[3] Ibid., page 581.
[4] Virchow's Archiv, vol. xlviii. p. 503.
[5] Virchow's Archiv, vol. xlviii. p 503.
[6] Ueber die Shicksal der ins blut injicerten Mikroörganism. Zeitschrift für Hygiene, Bd. i. Heft 1.

servative process in which the leucocytes are thrown out in great numbers, to destroy bacteria, and as a barrier to systemic infection. The peculiar relation of the bacilli to the nuclei in the giant cells themselves, suggests the possibility of an antagonism between the two. As the pathogenic qualities of infectious germs may in many instances be abrogated or diminished at will, as in the preliminary manipulation of bacteria used in vaccinations, by placing them under peculiar conditions of environment which rob them of their virulence, or modify it, so may the resisting power of their natural enemies, the cells of the body, be diminished or increased by the same means. Watson Cheyne,[1] in a review of some of his recent experiments, after describing the manner in which large quantities of putrefactive and non-pathogenic bacteria are destroyed when injected into the blood-current of rabbits, adds "but this does not occur if the animal is in a bad state of health."

Viewed in this light, the teachings of clinical medicine, the knowledge obtained by a study of the therapeutics of the disease, and the proof offered by experimental research, are in perfect accord. All measures which tend to increase the vitality of the body cells have been found to be precisely those which are most effectual in combating tuberculosis; one by one, specific methods of treatment, which for a season enjoyed popularity, have fallen into disuse, and hygiene, climate, and feeding—in other words, a favorable environment—have alone given results which have stood the test of time.

A consideration of the evidence offered by this study, therefore, teaches that though environment may bear but the relation of a predisposing cause to microbic infection, it is, nevertheless, a potent factor in determining the future type, and even the final results of the disease, and that if we may not under-estimate the pathogenic properties of the bacillus, the effect of extremes of environment on the resisting power of the cells of the body is an element in this complex problem which should not be ignored.

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## THE PUPIL IN ITS SEMEIOLOGICAL ASPECTS.

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Many observations have been made, from numerous standpoints, regarding pupillary conditions, yet with a few notable exceptions, they have been studied in an isolated manner, relative to the particular disease or lesion of which they might be more or less symptomatic. They have

[1] Bacteriology. Amer. Journ. Med. Sci., January, 1887.

been often looked upon, and are still regarded by some, as curious, interesting, but erratic phenomena, far too variable to be depended upon, and without any connecting thread upon which these conditions, as seen in a variety of diseases, could be strung. Few attempts have been made to grasp pupillary manifestations as a whole, still fewer to reduce the varying phenomena to principles or to reduce the laws by which they are controlled.

Among the papers dealing with the pupil as a whole, that of Dr. Alph. Drouin is one of the most complete, and the writer is indebted to that work for information, especially from the section devoted to anatomy and physiology. Mr. Hutchinson's excellent papers on the "Symptom Significance of Different States of the Pupil," published in the first volume of *Brain*, contain much that is of value, to which the reader's attention is directed.

In the present paper it is intended to give, first, with the view of refreshing the mind of the reader, a brief outline of the physiological phenomena pertaining to the movements of the pupil, and thereafter to present a series of personal observations from which certain conclusions have been drawn.

Physiological Outline.—The optic nerves have no direct control over the pupil. The impression produced by light falling upon the retina passes through the second nerves to the corpora quadrigemina, which communicate an impulse to the oculomotor centres, and so cause pupillary contraction. The second is thus the afferent nerve in this reflex (excito-motor) action. This reflex phenomenon may be brought about not only by the impression of light upon the retina, but also by mechanical stimulation of the optic nerves, which induces in them a sensation of light. When both optic nerves are divided or paralyzed, dilatation and immobility of the pupils ensue. Paralysis of one optic nerve produces dilatation of the pupil with blindness on the same side as the lesion; but owing to the preservation of consensual movements the pupil of the injured eye contracts when impressions of light are made upon the sound retina, though these are quicker and stronger on the sound side. Therefore, pupillary phenomena are sometimes wanting when only one optic is paralyzed, owing to the preservation of consensual movements; in this way it differs from unilateral lesions of the third, which always affect the corresponding pupil in a very definite way. Section or destruction of one optic tract produces dilatation of the opposite pupil, and blindness of the opposite eye.

The third nerve takes origin beneath the floor of the aqueduct of Sylvius, and supplies the ciliary muscle and sphincter of the iris, besides all the muscles of the globe with the exception of the external rectus and superior oblique. When the third nerve is stimulated contraction of the pupil on the same side ensues, and when it is divided or paralyzed

the pupil dilates; it no longer responds to the action of light, and accommodation is abolished. When the central portion of a cut oculomotor is stimulated, the opposite pupil becomes contracted, provided the nerve on the opposite side remains intact. In mydriasis as a sequent of oculomotor paralysis, the pupil may be made to dilate still further by either stimulating the sympathetic, or by the action of atropine. In man, pathological lesions of the third nerve generally result in mydriasis, though the writer has seen a case of a contracted pupil due to neuritis of the third on the same side; and M. Voisin found in one instance, in the case of a general paralytic who had unequal pupils, one of which was contracted, that there was an effusion of blood into the nucleus of origin of the third on the same side. Besides its action on the pupil, paralysis of the third when complete causes paralytic ptosis, strabismus outward and downward, slight protrusion, and immobility of the eyeball. There is, of course, inability to adduct the eyeball, and consequent double vision. It is well to recollect that paralysis may be confined to individual branches of the nerve. Unilateral affections of the third show themselves in the pupil on the same side as the lesion in the brain. Intracranial unilateral section of the fifth nerve causes on the same side as the lesion, fixity of the eyeball, contraction and immobility of the pupil. The want of sensibility soon leads to inflammation and ultimate destruction of the eyeball. The same pupillary effect is produced on section of the sympathetic, and some suppose that the action of the fifth on the pupil is due to the vasomotor filaments which it contains.

The centre for dilatation of the pupil is situated in the medulla oblongata. Thence the fibres make their exit partly through the trigeminus, partly through the lateral columns of the cord, in the ciliospinal region (from the sixth cervical to the third dorsal vertebræ), passing out by the two lowest cervical and the first two dorsal nerves into the cervical sympathetic. The latter fibres find their way to the iris, not only through the cervical sympathetic, but also by the cavernous plexus, lenticular ganglion, and ciliary nerves. It may be interesting to note, as having a bearing on the question of the power of the vasomotor system on the iris, that Landois and Stirling state that though the vasomotor and oculo-pupillary fibres "lie in the same trunk in the neck they do not issue from the cord by the same nerve roots; the latter come out of the cord with the anterior roots of the first and second dorsal nerves (dog), while section of the cord between the second and fourth dorsal vertebræ produces the vasomotor changes only."[1] It may, however, be difficult to ascertain whether the latter sections produce direct pupillary effects, as the pupil may be influenced by the state of the bloodvessels. More definite information on this point is necessary.

[1] Ferrier states that in the monkey the second dorsal is the only nerve issuing from the ciliospinal axis which produces dilatation of the pupil on irritation.

When the cervical sympathetic is stimulated, dilatation of the pupil ensues; and when it is divided or paralyzed, the pupil contracts. Similar results follow like causes applied to the medulla, and especially to the ciliospinal zone. Budge describes this as the centre for the dilatation of the pupil, and it may be looked upon as a secondary centre. If it be admitted that there are radiating fibres in the iris, then these are innervated by the sympathetic, causing dilatation of the pupil, while the oculomotor innervates the circular fibres. But Rouget, and many others, do not admit the existence of radiating fibres, explaining the action of the cilio-spinal axis on the pupil as being due solely to its vasomotor control.

When the cervical sympathetic is divided, the vessels of the corresponding side of the head, face, ear, and mucous membrane of the mouth, become dilated; there is sweating on that side of the head, elevation of temperature, the vessels of the iris are engorged with blood, and there is contraction of the pupil. If the peripheral end of the cut sympathetic be electrically stimulated all these phenomena disappear, and the pupil dilates. Many infer from these and other phenomena, that the action of the sympathetic on the pupil is exercised through the intermediary of the bloodvessels.

Unilateral excitation of the cord in the ciliospinal region produces dilatation of the pupil on the same side. Although the ciliospinal zone is specially susceptible to impressions giving rise to pupillary phenomena, yet irritation applied to almost any part of the cord is apt to be followed by dilatation of the pupil. This centre is likewise connected with the afferent sensory nerves, so that painful impressions on the skin and mucous membranes may reflexly produce dilatation of the pupils.

When the corpora quadrigemina are irritated, both pupils contract, and when destroyed, dilatation with immobility of pupils and destruction of sight ensue. It will be observed, that the pupillary effect is similar to that produced by lesions of the third nerve.

Were Longet's observation correct, one could remove from an animal the whole brain, with the exception of the corpora quadrigemina, without producing any pupillary indication. The writer would like to have further evidence on this point before accepting this statement as a fact.[1] Even were it the case, it would, as M. Drouin points out, not be correct to conclude that lesions of the cortical masses have no effect upon the movements of the iris, as various encephalic modifications have distinctive pupillary indications. It is supposed that there are two cortical motor centres for the pupil; the one situated in the base of the first and second frontal convolutions, which, on irritation, causes dilatation of the pupil

[1] Ferrier states that in animals deprived of their cerebral hemispheres, a flash of light before their eyes will cause the pupils to contract. Judging from this, the pupils must be either medium or dilated in such cases.

through the ciliospinal subcentre; the other located in the angular gyrus, connected with the nucleus of the third nerve by means of centrifugal fibres, which, when irritated, causes contraction of the iris with convergent eyes. These two centres in the cortex of the brain, stated to be connected so precisely, the one with the spinal centre, the other with the oculomotor beneath the aqueduct of Sylvius, are not yet definitely established, and in some measure are yet inferential.

In considering the manner in which cerebral lesions may act upon the pupils, it is necessary to weigh the possible participation of the various nerve centres, and the effects of modifications of the brain as a whole upon them, and also the relation of the state of the cerebral circulation to that of the iris.

The phenomena produced by lesions of the cerebellum upon the pupil are varied, generally myosis, occasionally mydriasis; both being accompanied by strabismus.

Meningeal affections may extend so widely that many parts of the brain and basal nerves may be implicated; and probably by reflex sympathetic action, changes may be induced in the eye and iris. When one remembers that the internal carotid supplies both the pia mater and globe of the eye, and that the same vasomotor centre supplies the vascular nerves of those arterial branches, the influence of the meningeal affections over the iris may be understood.

There is considerable divergence of opinion regarding the manner in which certain pupillary movements are brought about, and also as to the exact mechanism controlling these movements. While all admit the existence of the sphincter of the iris, there is no unanimity as to the mode by which dilatation is effected. While some believe that there are muscular radiating fibres whose function it is to dilate the iris, others deny their existence, believing that the dilatation and contraction of accommodation take place in virtue of the inherent elasticity of the iris. Those holding the latter view say, physiology shows that the movements of the iris are controlled in two ways, the one being functional or active, relating to accommodation during the exercise of vision, the other being passive, depending on the variations of the circulation in the encephalon and iris. The former movements are those arising from the impressions of light on the retina communicated through the second nerve to the corpora quadrigemina, which produce contraction of the pupil through the oculomotor acting on the iris. In those functional movements the changes in the pupil are brought about by the elasticity of the iris. The passive or vascular alterations of calibre are quite of a different character, and are independent of visual impressions, though the power of accommodation may remain. In those the movements of the pupil are regulated by the vascular system of the iris, which is in complete harmony with that of the encephalon. Myosis ensues when the vessels

of the encephalon and those of the iris are dilated; and dilatation of the pupil corresponds to anæmia of the encephalon and iris. It is in this way that congestion of the brain and its membranes, the result of paralysis of the cervical sympathetic, produces fluxion or paralytic dilatation of the vessels of the iris and contraction of the pupil; while in irritation of the sympathetic, in ischæmia of the brain, due to epilepsy, syncope, strong moral emotions, powerful irritation of the sensory nerves, etc., the vessels of the iris being contracted, mydriasis ensues. Regarding the action the various states of the encephalon might have on the pupils, it is said that one has only to determine what effect the lesions have on the circulation. Prominent among those who have advocated this view is Mosso, of Turin, who declares that the size of the pupil follows exactly the oscillations of the bloodvessels, and M. Drouin warmly espouses the same view, regarding the pupil as the manometer of the cerebral circulation. M. François Frank refutes this theory, and states that the movements of the pupil are quite independent of the condition of the bloodvessels; the evidence he advances in support is far from conclusive.

There is this difference between the influence exerted on the pupil by cerebral affections and those arising from the ciliospinal axis, the former can affect the size of the pupil in two ways: first, through the medium of the bloodvessels, second, by injuring the apparatus controlling the functional movements of the iris (the optic and oculomotor nerves and corpora quadrigemina); while the latter, the ciliospinal, can affect the pupils in only one way, by means of the reflex phenomena determining dilatation and contraction of the vessels.

Method of Examining the Pupil.—In examining the pupil, the shape, size, activity, and any difference existing between the two pupils, should be noted. The following rules ought to be attended to. The patient ought to face some source of light, such as a window.

1. Both eyelids ought to be closed, and after the lapse of a few seconds both ought to be simultaneously opened, when the observer should note whether they contract equally.

2. One eyelid should then be closed for half a minute; observe on opening it whether there be immediate contraction in that pupil, and whether simultaneous contraction takes place in the opposite pupil. The same should be repeated in the opposite eye. By this means an amaurotic eye would be detected, as in it the consensual movement persists, while the direct movements are abolished.

*Pupilometers.* Many pupilometers have been invented, such as those of Olbers, Follin, Fick, Badel, Galezowski, Landolt, Gorham, etc., some of them being ingenious instruments. For practical purposes, however, Hutchinson's idea of the disk of polished steel, with holes punched in it, or the simple narrow white card, having marked on it a

series of black dots, measuring from one to nine millimetres, is sufficient. When in use it is placed close to the eye, and the dot which corresponds most to the size of the pupil is noted, and its exact size in millimetres is read off. This has been employed by M. Drouin, and Dr. Finlayson figures it in his work on clinical medicine. The widest dilatation of the iris never exceeds nine millimetres.

Personal Observations on the Pupils.—The data upon which the following remarks are founded are based upon personal experience. The various facts were gleaned and recorded as isolated phenomena. It was only in reviewing and collating these, the conception evolved, that, besides the effect on the pupil of lesions of certain brain and spinal centres and their nerves, there were general cerebral conditions, which were accompanied by definite pupillary phenomena, with sufficient constancy to enable conclusions to be formulated regarding them. When these pupillary states are fenced with proper reservations, they form valuable aids to the diagnosis of some of the general conditions of the brain.

When the function of the brain is temporarily suspended, the pupils are in a state of stabile mydriasis. It matters not what the cause of this suspension of function may be, the pupillary phenomena are identical as long as this condition lasts.

In peripheral injuries, involving large extents of surface, such as the mangling of both thighs by a railway accident, a state of shock is frequently induced, in which, along with complete insensibility and the usual accompanying phenomena, the pupils are widely dilated and fixed. Reaction in such cases is often heralded by an alteration in the pupillary state, the mydriasis giving way somewhat, the pupil at the same time becoming mobile, and soon after, vomiting or other sign of reaction sets in. The same phenomena are seen when shock is induced by blows upon the epigastrium, by severe pain, such as may be occasioned by injury of the testicle, and by powerful mental impressions. Again, when, instead of the injury being peripheral, it is applied to the brain itself, and is of sufficient severity to cause suspension of the cerebral function, the pupils are widely dilated and fixed.

As to this state of central shock or cerebral concussion, writers are at variance with one another concerning the pupillary condition attending it. Some state that the pupils are dilated, others that they are contracted, most that they are variable, while a few state that they are unequal. Hospital surgeons, who make a daily or a less frequent visit to their wards, have few opportunities of seeing uncomplicated cases of concussion of the brain, as in the majority of instances the phenomena attending this condition pass off within a period of hours, and in many before the patient reaches the hospital. As an "interne" in the Royal Infirmary, the writer witnessed a number of such cases, the symptoms

in each of these passing off in a few hours; and afterward, while occupying the post of Casualty Surgeon in Glasgow, the writer had the fortune of seeing, and the opportunity of observing to a conclusion, at least twenty well-marked instances. The data thus derived pointed clearly to the conclusion that in uncomplicated cases of concussion the pupils are widely dilated and fixed. One of the earliest indications of recovery from this state is to be found in the pupils, the wide dilatation relaxing somewhat, accompanied by a slight mobility. During the period of rallying the pupil is very variable, and generally more or less contracted. In cases of concussion, which are complicated by brain lesion, such as slight compression, the pupillary phenomena, the result of concussion, remain until the latter state passes off, when the slight compression manifests itself, among other ways, by a pupillary state, such as inequality, contraction, etc. In this way, concussion may temporarily mask other and more serious, though more limited brain lesions, which may manifest themselves when it has subsided. If these two conditions are not discriminated, the pupillary phenomena of the one may be attributed to that of the other.

In hemorrhage considerable loss of blood may be borne without inducing marked pupillary changes, as long as the blood be not removed from the body so rapidly as to induce syncope. When, however, the amount of blood lost is great, equalling one-seventh of the whole, the cerebral irritability is increased, and is accompanied by myosis. When the depletion is carried much further, so that the amount lost is equal to one-fifth of the whole, the cerebral anæmia is so great as seriously to reduce the functional power of the brain; then the pupils are dilated, and if this depletion be pushed so as to induce syncope, they become widely dilated and fixed. When they are in this condition, it is interesting to note how quickly they undergo change when the cerebral anæmia is dispelled by lowering the head and raising the limbs, so as to empty the latter of their vascular contents, and thereby replenishing the heart and brain. The pupils then become mobile, less dilated, and may fall to medium size, or even become contracted, according to the amount of blood thrown into the cranium. This is quite in accordance with the observation of B. Séquard, who has shown that when an animal is suspended by the hind legs, contraction of the pupil occurs, comparable to that obtained by ablation of the superior cervical ganglia.

Much the same pupillary phenomena are seen during the action of drugs which affect the cerebro-spinal system, even in those which, in the first instance, produce myosis. In such, if the action of the drug be pushed, a stage is arrived at, when the function of the respiratory and cardiac centres is so seriously compromised that the pupils become widely dilated and fixed. This may be illustrated by the action of three drugs, opium, chloroform, and alcohol. When the physiological effect

of a large dose of opium is fully established, the pupils are in a state of stabile myosis, and continue so as long as the cardiac and respiratory centres are active. When the dose is sufficiently large this stabile myosis is succeeded by a rapid change to that of stabile mydriasis, indicating that the function of the cerebrum and the medulla has been so dangerously interfered with, that it falls practically into abeyance, the cardiac action continuing for a brief period, partly through the inherent ganglionic cardiac centres, the respiration meanwhile being extremely slow, irregular, and gasping. If energetic measures are not promptly adopted, the life of the patient is measured by minutes. This has been verified by frequent instances. Though a most dangerous symptom, it is not absolutely hopeless, as is illustrated by a case of this kind which fell under the writer's observation, in which the patient was restored by means of artificial respiration continued for two consecutive hours (the stomach having previously been duly washed out). At the termination of an hour and a half, when a pause was made in the artificial respiration, in order to test the condition of that function, there was only one gasp, as if the air had just distended the lungs after their artificial compression. The pulse, at the same time, was a mere thread, difficult to perceive. At the end of another quarter of an hour, feeble, shallow respiratory efforts were made by the patient. The artificial breathing was carried on for a further period of fifteen minutes, during which the lividity of the face and surface of the skin cleared away, and after that the patient was able to breathe without further aid. Patient ultimately recovered, and was alive four years afterward. It was interesting to note that after she had recovered partial sensibility, and when she was able to breathe of her own accord, the pupils returned to the condition of myosis from that of mydriasis, in which they had been during the time that artificial respiration had to be continued; or, in other words, they remained dilated until the function of the brain had partially recovered.

This condition of stabile mydriasis setting in so rapidly, and taking the place of the myosis, shows that the opium has no longer the power of asserting its well-known influence on the pupil in the presence of the suspension of the brain function. The change indicates that death is imminent. The mechanism producing contraction of the pupil in these instances may probably be the congestion of the brain and its membranes, as well as the ocular vessels; and the rapid dilatation of the pupil to the anæmia coincident with the suspension of function.

It is probable that statements made in some text-books, regarding the action of opium, as occasionally causing dilatation of the pupils may be explained in this way. When death ensues after opium-poisoning, the pupils first relax somewhat, and then become medium. From this it will be seen, it is quite erroneous to suppose that the pupils will neces-

sarily be found contracted in the cadaver after death from opium-poisoning. In six instances which have come under personal observation, the pupils were found to measure from four to six millimetres after death, although they measured about two millimetres shortly before death. It is right to remember that the apparent congestion of the internal organs in opium-poisoning may, in part, be due to the great fluidity and dark color of the blood.

The coma arising from alcohol, as was pointed out by me in 1879, may be distinguished from that due to other causes by the fact that when the patient is left lying undisturbed for twenty minutes, the pupils are in a state of myosis, pin-head contraction. If an attempt be then made to arouse the patient by shaking him, or pulling his hair, though he still remain quite comatose, his pupils will slowly dilate, until, if the physical irritation be continued, they become fully dilated. If the patient be then left undisturbed, the pupils remain dilated for a period of variable duration—minutes, as a rule, after which they begin to contract, doing so at a very slow rate until they reach their former dimensions. The time taken for the transition from the fully dilated stage to that of pin-head contraction, is from five to ten minutes, varying according to the intensity of the coma. In some rare cases, where the coma is very intense, the change is completed in less than five minutes. In instances in which the patient is not deeply comatose, the dilatation continues for ten minutes, and then contraction sets in at a very sluggish rate. In persons in whom the alcoholic coma is passing off, and who are merely insensible, and who can be temporarily roused, the dilatation of the pupil once established continues, or it may become smaller, though it does not again attain the same degree of contraction it formerly did. These observations have been subsequently verified in many hundreds of cases. In some uncommon instances of cerebral compression, through apoplexy or other cause, the contracted pupil will be slightly enlarged on stimulation (not full dilatation, as in alcohol), and very soon, in most, immediately thereafter, it will contract to its former size.

But when the dose of alcohol is poisonous, and the patient is about to succumb from its effects, the pupils, after being contracted as above, pass rapidly into complete stabile mydriasis. This is a condition which must be very seldom seen as arising from alcohol, but was once observed by the writer, in the case of a man who had half an hour previously drank off at a draught a quart of strong alcohol (proof strength); the pupils becoming widely dilated and fixed, the patient dying fifty minutes afterward. Here the function of the medulla had become interrupted, and finally suspended, just as in opium-poisoning.

In chloroform narc[illegible]is, the same pupillary phenomena are observed during the extreme stages. From personal observations, extending over several hundred carefully recorded cases, it is seen that the pupils are in

a very variable state during the preliminary periods, much too variable to permit any rule being formulated regarding them. When, however, reflex action is abolished, except in the cardiac and respiratory centres, the pupils become contracted and fixed. This may be regarded as the safety zone of complete chloroform narcosis. But if the anæsthesia be pushed beyond this stage wide dilatation of the pupils ensues, indicating a suspension of function in the cardiac and respiratory centres. This is a most critical condition, though one by no means necessarily fatal, as by lowering the head and raising the floor of the table, and by promptly carrying out artificial respiration, even while feeble respiratory efforts are being made by the patient, the danger may be, and very frequently has been averted. Given a person free from organic lesion of the nerve centres, heart, or lungs, in whom during chloroform narcosis, stabile mydriasis suddenly occurs as a result of the action of chloroform on the respiratory centres, the patient ought to recover, if artificial respiration coupled with the lowering of the head, be promptly resorted to, and the former efficiently carried out. It is interesting to note in such cases the marked effect produced by elevating the foot of the table, so as suddenly to place the patient's head and thorax at a very low level, the pupils becoming quickly contracted. In this connection, however, it ought to be borne in mind, that one of the earliest indications of a return of reflex action is vomiting, which, as a rule, is accompanied by dilated pupils, the result of cerebral anæmia.

In cases where the functions of the cerebrospinal system, especially of the cardiac and respiratory centres, have already been enfeebled (by organic lesion or otherwise), chloroform acts more powerfully; a few whiffs sufficing to induce complete insensibility, and the administration of an ordinary dose giving rise to an alarming state, which only prompt measures can prevent from becoming fatal. In such cases the pupils very readily pass into wide dilatation with a very small amount of chloroform.

When the function of the brain is suspended by want of oxygenated blood, the pupils are widely dilated and fixed. This may be seen in cases of asphyxia either by poisonous gases or arising from mechanical causes. It was once observed by the writer in two men who had all but succumbed by inhaling coal-gas, emanating from a broken gaspipe in their bedroom; and it is also seen in cases of hanging.

Turning to the effects of pressure exercised upon the brain as a whole, it produces pupillary states varying according to its amount. When it is sufficient to place in abeyance the cerebral function, mydriasis occurs; and when of much less degree, causing only a small area to be involved, it is usually followed by myosis. The following is a typical case, illustrating these points as well as the most carefully planned and skilfully executed experiment could do.

While acting as House Surgeon in the Royal Infirmary, Glasgow, in 1870, the writer had the opportunity of observing the following case:

A well-developed and strongly built man, about twenty-eight years of age, was brought into the Infirmary in an unconscious state, having fallen from a height about an hour previously. There were bruises on his face, nose, and forehead, and there was slight oozing of blood from both nostrils. He was deeply comatose, his breathing was stertorous, his pulse slow and feeble, and the pupils of both eyes were widely dilated and fixed. Urine and feces had been passed involuntarily. This state continued for fully half an hour after admission, during which his pulse became so feeble, as sometimes to be scarcely perceptible; his breathing was even more deeply stertorous, and it was accompanied by lividity of the face. At the expiration of this period, a sudden gush of blood from both nostrils poured forth as a torrent, causing wide distention of the nasal alæ. This continued for full two minutes, then quickly lessened in quantity, becoming a mere trickling, which lasted half an hour. The pupils, which had been widely dilated and fixed from the time of his admission into the hospital up to the very moment when the blood began to escape in such volumes from both nostrils, were found at the expiration of two minutes, during which it flowed, to have become medium, to be quite active, readily contracting when exposed to light, and quickly dilating when shaded. Along with this, the lividity of the face disappeared, the breathing became free, though the pulse was extremely weak, and the patient pale. He however soon recovered consciousness, answered a number of questions correctly, and expressed surprise at finding himself in the infirmary. He also remembered, and was able to describe some of the circumstances connected with the accident which caused his injuries. This stage lasted two hours, the pulse and color of the face steadily improved, and during the whole time the pupils were active and normal. Half an hour later, the pupils began to be sluggish and contracted. Three hours after the hemorrhage they were very sluggish and contracted. Four hours later, they did not respond to light, though they were not so contracted as they had been half an hour previously. Patient no longer answered questions, but still was sensible to external impressions, especially of a painful kind. Six hours after the hemorrhage the patient was deeply comatose, and otherwise much in the same condition as when admitted, his pupils having again become widely dilated and fixed. Ten hours subsequently to the hemorrhage (ten and a half hours from admission) breathing became very labored, the lividity of the face marked, pulse flickering, and death ensued about twelve hours and twenty minutes after the hemorrhage from the nose.

The post-mortem examination showed that the cribriform plate of the ethmoid was extensively fractured, the aperture between the fractured bones being filled with clot; the crista gallæ was driven upward, the anterior part of the longitudinal sinus was ruptured, and a clot of blood existed between the dura mater and the skull, filling the greater part of the anterior fossæ, and pushing backward the brain. Both frontal lobes were much compressed, the convolutions were flattened, and the brain tissue comprising them was somewhat softened. The brain, as a whole, bore evidence of compression, but it was otherwise healthy. With the exception of a fracture of both bones of the leg, there were no other injuries.

REMARKS.—This case may be divided into four periods, each being accompanied by a peculiar pupillary condition. First, there was a period of severe intracranial pressure, indicated by symptoms of cerebral compression, in which the brain function was for the most part suspended. The pupils at this stage were widely dilated and fixed. This condition was present at the time of patient's admission, and half an hour afterward ended abruptly on the escape of blood from the interior of the skull. Second, with the relief of the intracranial pressure, the indications of compression of the brain disappeared, its functions returned, the patient regaining consciousness. The pupils then became normal, responding actively to the alternate action of light and shade. This state was the immediate sequence of the relief of the pressure on the brain by the escape of the pent-up blood, and it continued for two hours, until after the period of reaction had set in. Third, there was a period of slight cerebral pressure, due to the recurrence of hemorrhage within the skull, occurring shortly after reaction had set in. This was the direct result of the reaccumulation of blood within the skull, and the consequent pressure on the brain, a clot having filled the aperture in the fractured ethmoid. The patient in this stage had become drowsy. The pupils gradually lost their activity, becoming very sluggish and somewhat later contracted. This period lasted about four or five hours. It corresponded to slight cerebral pressure. Fourth, a stage of severe intracranial pressure ensued, marked by all the symptoms of cerebral compression and accompanied by widely dilated and fixed pupils. This lasted about four and a half hours, ending in death. This corresponded to the first stage on admission, the function of the brain having again become suspended. In a tabulated form it would appear thus:

| *Pressure.* | *Action on Brain.* | *Effect on Pupil.* |
|---|---|---|
| 1. Very severe. | Function almost in abeyance. | Stabile mydriasis. |
| 2. Removal of pressure. | Restoration of function. | Normal and active. |
| 3. Slight. | Interruption of function. | Contracted and sluggish. |
| 4. Very severe. | Suspension of function, ending in its abolition. | Stabile mydriasis. |

The same pupillary phenomena arising from pressure, induced by a pathological cause, are illustrated by a case of tubercular meningitis with its accompanying effusion, which is given elsewhere in detail. On admission, the patient, who was insensible, gave vent to the peculiar "hydrocephalic cry." She could move her limbs freely, her pupils were in a state of myosis (stabile). At this stage, it was probable that she suffered from interference with cerebral function, caused by effusion of fluid exercising a degree of pressure on the brain. A few days subse-

quently, she became unconscious, pulse very feeble, respiration labored and shallow accompanied by great lividity of the face, and a markedly subnormal temperature. The pupils were then in a state of stabile mydriasis. It was diagnosticated that the fluid had further increased, and was now exercising very severe pressure on the brain, placing its function in abeyance, with the exception, perhaps, of the respiratory and cardiac centres, which, though seriously interfered with, were still able to act to a slight extent. To relieve this pressure, a puncture was made through the brain membranes, when a large quantity of cerebro-spinal fluid escaped in a jet. While the fluid flowed away, the respirations improved, the cardiac impulse increased in strength, the lividity disappeared, the pupils became much smaller, and shortly afterward became normal in size and sensitive to light, though they were somewhat sluggish. This condition continued for twenty-four hours, the temperature increasing from subnormal to 102.8° F. Ultimately the patient died.

The condition may be thus formulated:

| *Pressure.* | *Action on Brain.* | *Effect on Pupil.* |
|---|---|---|
| 1. Slight. | Interference with function. | Myosis. |
| 2. Severe. | Function in abeyance. | Stabile mydriasis. |
| 3. Removal of pressure. | Function nearly quite restored. | Mobile and almost normal. |

*Twelve cases of obliteration of function from pressure and bruising of the brain.* Numerous instances of severe injury to the cranial contents have been observed by the writer in which both pupils were widely dilated and fixed; post-mortem examination afterward showing extensive destruction of the cerebral substance. In twelve such cases the patients died within a few hours after the accident. The post-mortem in these showed, besides serious injury of the skull, that both cerebral hemispheres had been encroached upon by extensive extravasations of blood, or by portions of bone or foreign matter driven into the cerebral substance, exercising severe and general pressure and producing extensive laceration of the brain. In all of them there was destruction of both hemispheres, sufficient to obliterate function.

*Four cases of extensive bruising and laceration of the brain without pressure.* Besides these, there were four cases in which a sufficient hiatus had been formed in the osseous walls of the skull to prevent the possibility of pressure being exercised on the hemispheres, and yet the pupils were dilated; the extensive laceration and severe bruising of the brain having destroyed the function of the part. Nor is the widely dilated and fixed pupils arising from cerebral pressure limited to surface lesions, or such as are caused by traumatism. In cases of extensive

hemorrhage from the basal or deep cerebral arteries, causing great pressure or laceration of the brain, widely dilated and fixed pupils are seen, and they are accompanied by abolition of cerebral function. In one instance of this kind which came under personal observation, the lateral ventricles had become greatly distended with blood, the coma was profound, and both pupils were in a state of stabile mydriasis, this being the usual condition of the pupils in such lesions. In another instance, a large cerebral abscess had burst into the ventricles and this was notified by the sudden accession of deep coma, accompanied by widely dilated and fixed pupils. These phenomena are in accordance with those observed by others, who have pointed out that congestion of the membranes and slight hemorrhage into the ventricles is accompanied by contraction of the pupils, while profuse hemorrhage into the ventricles produces dilatation of the pupils. In the latter case, it is supposed that the result ensues from compression of the common motors, but the pressure no doubt causes suspension of function of the brain as a whole.[1]

It is true that cerebellar hemorrhage is generally indicated by contracted pupils, but this is not always so. When the pupils are contracted the extravasation is slight, but when the outpouring of blood is much greater, then dilatation ensues. It is not often that dilatation is seen from hemorrhage into this seat, on account of the great importance of the structures in the immediate vicinity, a comparatively small lesion producing a fatal result.

*Both pupils dilated and fixed from very large unilateral lesions.* In other instances both pupils were dilated and fixed, the lesion being unilateral, though indirectly the opposite side of the brain was implicated. Six cases of this kind were observed. All of them had sustained fracture through the middle fossa with rupture of the middle meningeal artery or one of its branches, from which extensive unilateral extravasation of blood had taken place. In a general way, these fractures may be described as extending from the base to above the level of the parietal protuberance, and the extravasated blood from the base of the anterior fossa to the posterior part of the middle fossa. The pressure was greatest opposite the middle lobe, the prominences of the convolutions being there effaced, and the outer wall of the lateral ventricles being flattened. In at least three of these the opposite hemisphere was involved directly by the pressure which was communicated through the falx cerebri, a slight concavity on the inner side of the opposite cerebrum indicating the seat of pressure. The opposite hemisphere, from the one flattened by direct contact with the blood clot, would likewise have been affected by the increased amount of cerebro-spinal fluid displaced by the blood clot from the other hemisphere, though the pressure from this

[1] M. Jordan states that "dilatation and total immobility of the pupils on the approach of a lighted candle is one proof of great engorgement of the brain in apoplexy." Dict. des Sc. Méd., 1878.

cause could not be great, distributed as it would be over the whole cerebro-spinal axis. In these instances the patients survived the injury by only a few hours, during which they were plunged in profound coma, and therefore it is possible that the dilatation of the pupil on the side opposite the lesion might have resulted from suppression of brain function (concussion) on that side; though it is probable that the pressure communicated from the lesion in itself exercised a powerful action. It is further possible that the ablation of function by pressure of the white fibres of the centre of the hemisphere would in itself have produced the paralytic mydriasis of the opposite side, though this is much more prone to occur when the blood is extravasated into the interior of the brain.

*One pupil dilated and fixed, the other contracted, accompanied by lesions on both hemispheres.* A few instances occurred in which, with lesions on both sides of the brain, one pupil was in a state of extreme dilatation with fixity, the other was contracted and fixed. In the first instance of this kind, there was a clot weighing not quite half an ounce on the external surface of the dura mater, over the right hemisphere, opposite the anterior ascending convolution, while there was extensive laceration of the middle lobe of the left hemisphere, with its accompanying extravasation of blood. The patient was insensible, and lived for eighteen hours. The left pupil was widely dilated and fixed, the right was contracted and fixed. The function of the left hemisphere had been abolished, while that of the right had only been partially interfered with. In the second instance there was slight laceration of the cortical substance, principally on the base of the first and second left frontal convolutions, with its accompanying extravasation; while on the right side there was an extensive blood clot which filled the subdural space, the dura mater having been ruptured by a spiculum of bone which had penetrated a branch of the middle meningeal. The patient was insensible, surviving the accident by only four hours. During life the right pupil was dilated, and the left was contracted, both being fixed. In the third case there was an extra-dural clot of blood weighing three ounces, situated principally over the outer portion of the left middle fossa; while on the right side, at the junction of the parietal with the occipital bone, near the vertex, there was a small depressed fracture, an osseous spiculum having penetrated the dura mater. This patient was insensible, and lived about forty-eight hours afterward. He had other bodily injuries of a severe kind, which, however, did not exercise any material effect on the brain-function. The right pupil was slightly contracted and very sluggish, while the left was dilated and fixed. In the fourth, there was a very thin diffuse layer of blood spread over the surface of the pia mater covering the convolutions in the anterior portion of the middle lobe of the left hemisphere; while on the right hemisphere there was an extensive laceration and extravasation into its middle and posterior lobes.

Patient lived a few hours after the accident, during which he was insensible. The right pupil was dilated and fixed, while the left was slightly contracted and sluggish. Some would ascribe these results to irritation and paralysis respectively of the oculomotor; while others would look upon them as due to vascular changes in connection with the cerebral lesions.

*One pupil dilated and fixed, the other normal.* Many instances have been observed of dilatation and fixity of one pupil, while its fellow, perhaps with the exception of a little sluggishness of movement, remained normal. These were all cases of fracture of the middle fossa of the skull, and in comparatively few of them was the diagnosis verified by post-mortem examination, though little doubt could exist as to the lesion when accompanied, as they were, by the usual phenomena of hemorrhage from the ear, followed by discharge of cerebro-spinal fluid, ptosis, occasionally external strabismus, facial hemiplegia, and paralysis of members. In such the patient was generally insensible at the outset when both pupils were dilated and fixed. As the patient recovered consciousness, one pupil became normal while the other remained dilated and fixed, this being on the side of the lesion. In some of these the visual power on the same side as the dilated pupil was in abeyence; in others, it was imperfect, and in a few it was almost normal. The pressure exercised by the blood-clot must have been sufficiently great to place in abeyance the function of the greater part of the affected hemisphere, as evidenced by the complete paralysis of the opposite member, the interference with vision, and the evident effect upon the third nerve. In those cases in which post-mortem examinations were obtained, the basal fracture was continued into or toward the vertex, and the clot in most instances occupied the whole of the middle fossa from the petrous portion of the temporal to the vertex, the convolutions, especially the ascending, being considerably compressed. The opposite hemisphere was in almost a normal condition. In those that recovered, the dilatation gave way slowly, and was followed by a degree of contraction along with sluggishness of movement which ultimately passed off; though in one case it still remained small and sluggish at the termination of the fifth month from the date of the accident. These changes were evidently determined by the gradual absorption of the blood-clot. It is more than likely that in most of them the third as well as the seventh nerve was paralyzed, and in one or two instances the fifth in addition, as indicated by the loss of sensation on the affected side. Occasionally the second was interfered with. Hearing was generally much affected, if not absolutely in abeyance on the affected side, during the early months, mechanical obstruction by blood-clot producing loss of hearing as well as interference with the nerve.

*Pupil contracted on only one side.* Quite a number of cases have been

observed by the writer in which, while one pupil was normal, its fellow was contracted and fixed, and where, judging from other symptoms, a cerebral cortical lesion was diagnosticated as existing on the same side as the affected pupil. In at least three of these instances the diagnosis was verified by demonstration of the lesion on the operating table, and by the fact that its removal was followed either by great amelioration of the state of contraction, or by its complete relief. One was a case of fibrous tumor of the dura mater, situated over the left anterior lobe, which exercised pressure on the surface of the first and second frontal convolutions. The pupil on the same side as the lesion was minutely contracted and fixed. Operation was demanded for epileptoid seizures. The tumor was removed, and the patient recovered. The activity of the pupil very soon returned, and the contraction was in great measure removed within a few days subsequent to the operation. Ultimately the two pupils acted alike. The second was a case in which there was a cortical extravasation of blood from a bruise of the ascending frontal convolution, and which was surrounded by an area of irritation. The pupil on the same side was contracted and fixed. The lesion was removed by operation. The patient recovered, and the contraction, though at first remaining to a slight extent, disappeared completely within a month. In the third instance, the dura mater over the right frontal region was punctured by an osseous spiculum. The pupil of the corresponding side was minutely contracted. On the removal of the fragment of bone, and the escape of a small quantity of fluid blood from under the dura mater, the contraction of the pupillary sphincter relaxed immediately. Four hours afterward the pupil responded slowly to alternate light and shade. Two days after operation it was quite normal. There are many explanations advanced for such pupillary effects arising from these lesions. The influence of the dura mater on the basal nerves has to be borne in mind, especially when it is inflamed; also that of the possible effect which might be transmitted through the fibres of origin of the optic to its centre, and so to the third nerve; and, again, the effects of irritation arising from pressure exercised on the two alleged centres of pupillary movement in the cerebral cortex. All of them could, however, be more directly explained by vascular changes accompanying these lesions producing their effects upon the vessels of the eyeball.

It is interesting to note that in cerebral softening the action is like that of hemorrhage into the brain, producing abolition of function and dilatation of the pupil. In some such cases there is no doubt that the oculomotor nerve has also lost its power, as indicated by the loss of ocular movement; but in others the movements are retained, the pupil, however, being dilated.

*The effects of spinal lesions on the pupil.* There have been very many instances under personal observation of spinal irritation inducing labile

mydriasis, and there have been a few of complete lesion of the cord causing stabile myosis. Of the latter, one occurred in a man of fifty years, the subject of a sarcoma involving the bodies of the lower cervical vertebræ pressing upon the spinal cord and ultimately crushing it. The pupils were about two millimetres in diameter, and fixed. The vessels of the head and face were dilated, and the conjunctivæ were suffused. One was a child, aged five years, affected with tubercular infiltration and destruction of the bodies of the third, fourth, and fifth cervical vertebræ, opening up the canal and exposing its contents. An abscess formed, which involved a limited area of the spinal canal opposite the affected vertebræ. The anterior portion of the theca was represented by a fungated process of granulation tissue; the cord was in a much softened condition, and was surrounded with pus. The pupils, which for months had been in a state of labile mydriasis, became, during some days prior to death, contracted to two and a half millimetres in diameter. Several traumatic lesions of the cord in the upper dorsal and lower cervical vertebræ have been observed, accompanied by myosis, the contraction being from two to three millimetres. In each of those death ensued within some hours or days from date of injury. In all there was destruction of the cord at the seat of injury; in some, to the extent of severance of almost its entire calibre.

In the foregoing there is sufficient evidence to show that the suspension or abolition of cerebral function in the living body is attended by mydriasis, the latter being the sequent of the former. If inquiry be made concerning the mechanism inducing this pupillary effect coincident with the arrest of cerebral function, the theory which explains the greater part, if not the whole of the phenomena, is that which has been so ably advocated by Mosso. The passive movements of the pupil are regulated by the vascular system of the iris, which is in complete harmony with that of the encephalon. In those conditions inducing general suspension of the cerebral function, a state of ischemia prevails in the brain and iris inducing mydriasis. This, likewise, obtains in unilateral lesions, where the pressure is so great as to induce anæmia of brain and iris. Myosis may also be brought about by a like mechanism acting in the opposite direction. The "irritation" setting up congestion of the cerebral and meningeal vessels, leads to congestion of the vessels of the iris, and so produces contraction of the pupil.

When investigating the cause of a given pupillary state, this should be done in a methodical manner, examining the various sources controlling pupillary movements, and eliminating those which do not apply. The examination ought to be conducted by answering, *seriatim*, the following questions:

1st. Is the pupillary condition due to the local or constitutional action of any drug?

2d. Is the state of the pupil dependent upon any local ocular lesion or optical defect (including artificial eyes)?

3d. Is it due to any spinal or sympathetic lesion, more especially of the cilio-spinal region and the cervical sympathetic?

4th. Is it dependent upon any localized cerebral lesion affecting special brain centres—*i. e.*, corpora quadrigemina, optic thalamus, or the origin and intracranial course of the second, third, and fifth nerves, especially the third?

5th. If due to none of the above, the probability is that it depends upon either a suspension of brain function or to some cerebral "irritation," in either case inducing vascular changes in the encephalon and iris.

The following points, among others, may be formulated from the foregoing:

(A) 1. When the function of the brain is in abeyance, the pupils are in a state of stabile mydriasis.

2. This may arise either from temporary suspension or from abolition of function.

3. Temporary suspension is illustrated by shock, and the effect of some poisons; while the abolition of function is exemplified by extensive laceration and compression of the brain.

(B) 4. When the function of the brain is interfered with by conditions usually included under the term "irritation," the pupils are in a state of myosis; sometimes labile, but generally stabile myosis.

5. This "irritation" or interruption of function may be seen during certain degrees of cerebral anæmia, produced experimentally, and not as a pathological result; certain amounts of brain pressure, and certain stages of intracranial inflammation.

6. These are illustrated in persons who have suddenly lost a considerable quantity of blood (about a fifth of the whole); in the growth of intracranial tumors and the formation of sanguinolent serous and purulent effusions, when the degree of pressure may be denominated as "medium," and at certain periods of meningitis and encephalitis.

(C) 7. The same pathological factors which cause myosis may also cause mydriasis, the degree in which these factors are present being the determining point between the former and the latter, and not *merely* the particular locus in the brain.

8. It is well illustrated by cases where the hemorrhage is repeated, and is finally pushed to syncope; in intracranial pressure, which is gradually increased until it becomes great, such as arises from tumors, blood clots, and inflammatory products.

(D) 9. When the function of one-half of the cerebrum is placed in abeyance by a superficial or cortical lesion, the pupil on the same side as the lesion is in a state of stabile mydriasis.

10. This is well illustrated in cases of intracranial sanguinolent effusion consequent on injury (see list of cases).

(E) 11. When the function of one-half of the cerebrum is interfered with by some source of cortical irritation, the pupil on the corresponding side to the lesion is in a state of myosis.

12. This is illustrated by traumatic and pathological lesions affecting the cortex of the cerebrum (see list of cases).

(F) 13. Hemorrhage into the pons Varolii when small, causes strongly contracted pupils; but when it is more extensive, involving the gray matter beneath the aqueduct of Sylvius, a state of stabile mydriasis is induced.

14. Effusions into the lateral ventricles when small, produce contraction of the pupils, but when the effusion is great stabile mydriasis ensues.

15. Inequality of the pupils indicates a unilateral lesion or lesions.

16. When the lesion is cortical and unilateral the pupillary manifestations are on the corresponding side. When the basal nerves are affected unilaterally the pupillary effect is manifested on the same side as the lesion. When the lesion is unilateral and affects the function of the white fibres of the cerebrum the opposite pupil is generally affected. When the basal ganglia are implicated unilaterally the pupil is sometimes affected on the same side as the lesion, occasionally on the other side.

In a case of cholesteatoma and in another of glioma of the right optic thalamus, dilatation of the left pupil was found (*Ross*, vol. ii. p. 572).

In lesions of the cerebral peduncles the pupil is affected on the same side as the lesion.

Lesions in the corpora quadrigemina affect both pupils, irritation[1] causing contraction, destruction causing dilatation and immobility.

Section or destruction of one optic tract, causes dilatation of the opposite pupil and blindness of the opposite eye.

17. Irritation of the cord, especially the cilio-spinal axis, produces dilatation of the pupils, while destruction of the cord causes contraction. These effects are generally seen in both pupils, though, experimentally at least, they may be confined to the same side as the lesion.

18. The pupils are affected in the same way by lesions of the sympathetic, though in unilateral lesions it is only the pupil on the same side as the lesion which is affected.

19. Speaking generally, when myosis is due to a cerebral cause, it indicates the earlier stages of various affections; when due to a spinal

[1] Unilateral electrical stimulation causes dilatation of both pupils, the opposite one becoming first dilated. Ferrier explains this as the result of irritation of a sensory structure, in this case acting through the medium of the anterior roots of the second dorsal nerves which ascend in the cervical sympathetic.

lesion, it points to a most serious paralysis, often to the destruction of the part. When mydriasis arises from a cerebral lesion it is generally present in large amount; when due to a spinal affection it indicates irritation of the part.

Myosis Occurs under the Following Conditions:

1. When a bright light acts upon the retina.
2. Accommodation for a near object.
3. Rotation of the eyeball inward.
4. Local irritation or painful affections of the eyeball.
5. Irritation of the oculomotor nerve.
6. Paralysis of sympathetic roots of lenticular ganglion or trunk of sympathetic in the neck. In paralysis of the fifth there is myosis and inflammation passing on to destruction of the eyeball.
7. Paralysis of the ciliospinal region of spinal cord. All affections which destroy the cervical spinal marrow and intercept its conductibility produce congestion of the face and contraction of the pupils. In neurosis, which suspends or diminishes the tone of the sympathetic or spinal axis.
8. Encephalic congestion, such as: obstacle to return of blood in jugulars; venous congestion due to cardiac causes; active hyperæmia, plethora, fevers, pneumonia, hepatitis, etc.; when animal is suspended by the heels; in early stages of meningitis and encephalitis; in acute mania with marked activity of the cerebral circulation; in chronic mania pupils are variable, when contracted are said to indicate supervention of paralytic dementia.
9. During sleep; some believe this to be due to the congestion of the cerebral vessels and those of the iris (Mosso); others, to the inward rotation of the eyeball.
10. In the early stages of cerebral tumor.
11. In small hemorrhages into the cerebellum. In irritation of the cerebellum, contraction of the pupil on same side as lesion ensues.
12. Electrical stimulation of the angular gyrus frequently causes contraction of the pupil.
13. During forced expiration, when the eye is at the same time passive. Also generally seen during the period of apnœa in Cheyne-Stokes respiration.
14. Convulsions arising from meningo-encephalitis are said to be accompanied by myosis, while in convulsions due to epilepsy and in epileptiform fits they are usually accompanied by mydriasis.
15. When the eye contracts on accommodation to a near object, yet does not contract to light, this indicates a lesion situated between the corpora quadrigemina and the oculomotorius. This affection is known as the Argyle-Robertson symptom. It is seen in locomotor ataxia and occurs in the progressive paralysis of the insane.
16. During uræmic coma.

17. Myotics: physostigmine, nicotine, pilocarpine, morphine, muscarine.

MYDRIASIS OCCURS UNDER THE FOLLOWING CONDITIONS:

1. In darkness or in subdued light.

2. Accommodation for distant objects.

3. Rotation of the eyeball outward.

4. In forced movements discharged from the medulla: vomiting, swallowing, chewing, forced respiration.

5. Paralysis of the oculomotor (accompanied or not by immobility of eyeball, external strabismus, diplopia, etc.).

6. Destruction of the optic: amaurosis. When unilateral, associated movements continue.

7. Irritation of sympathetic: powerful impressions on sensory nerves; strong moral emotions, mental pain, grief, fear; neuralgia of the fifth nerve.

8. Irritation of the spinal cord, especially ciliospinal region.

9. Encephalic anæmia: In all cases where there is reflex contraction of the vessels of the head; when loss of blood from the body is excessive; obstruction of the carotid arteries; in thrombosis of brain sinuses; dilatation of mesenteric vessels when extreme; syncope, intense cold, rigors; dyscrasias of the blood, convalescence, cachectic conditions; asphyxia, epilepsy, in certain stages of these affections.

10. Pressure of cerebrum when great in amount, as from hemorrhage, neoplasms, etc. In the last stages of meningo-encephalitis.

11. In cerebral softening. In acute dementia (œdema of cortex cerebri) observers state that the pupils are invariably dilated (Hutchinson).

12. In idiots the pupils are generally dilated.

13. During deep inspiration, generally in respiratory period of Cheyne-Stokes breathing.

14. Hemorrhage into centrum ovale and into cerebral peduncles.

15. Ferrier produced dilatation of opposite pupil by destructive lesion of the optic tract in the thalamus, indicative of rupture of the centripetal fibres to the irido-motor nucleus in the floor of the Sylvian aqueduct.

16. In hydrophobia there is mydriasis.

17. Mydriatics: atropine, homatropine, duboisine, daturine, hyoscyamine. Curare injected subcutaneously in animals (five to ten centigrammes) induces in one or two hours complete paralysis of the third nerve.

THE EFFECT ON THE PUPIL OF LOCAL CONDITIONS OF THE EYEBALL:[1]

1. Hyperæmia of the iris produces contraction of the pupil which darkness scarcely diminishes.

[1] The writer is indebted to Dr. Thomas Reid for revising this list of pupillary effects occasioned by local conditions of the eyeball.

2. Presbyopia and hypermetropia cause contraction of the pupils in cases where continuous and excessive strain for near accommodation has been long continued and has produced asthenopia.

3. Pupillary atresia, consequent upon chronic irritation with posterior synechia, producing contraction of the pupil.

4. In synechia total dilatation is impossible, the iris only dilating where free, hence, the pupil is irregular. If the synechia is annular the pupil is both contracted and immobile.

5. In microria there is a congenital state of extreme contraction.

6. In glaucoma the pupil is dilated, contracting little or not at all to the action of calabar bean.

7. In coloboma, both in the congenital form and after iridectomy, there are irregularity and immobility of the pupil.

8. In idiopathic mydriasis there is little contraction to the action of light or to myotics.

9. In certain cases of amblyopia and amaurosis there is dilatation of the pupil.

10. In hippus pupillæ there are alternate contraction and dilatation often accompanied by nystagmus.

11. Inequality of the pupils exists in some who have different degrees of refraction in the two eyes, one being emmetropic and the other myopic.

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## THE THERMAL DEATH-POINT OF PATHOGENIC ORGANISMS.

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An exact knowledge of the thermal death-point of pathogenic organisms is desirable, both as a matter of general scientific interest, and from a practical point of view. As biologists, we wish to know whether the vital properties of the living protoplasm contained in the minute vegetable organisms in question are destroyed at a uniform temperature, and if so at what temperature; or whether there is a considerable range in the limits of vital resistance to heat exhibited by different organisms of this class. As sanitarians, we wish to know what temperature can be relied upon for the destruction of disease germs in the excreta of patients suffering from typhoid fever, from cholera, and from other infectious diseases transmitted by means of the alvine discharges of the sick; whether boiling of infected clothing, or of drinking water contaminated with disease germs, is a safe means of disinfection, etc.

Various experimenters have recorded observations with reference to the thermal death-point of different microörganisms, but, so far as I

know, no one has heretofore made an extended inquiry, by means of a uniform method, with a view to determining the vital resistance to heat of the considerable number of pathogenic organisms now known to bacteriologists.

All of the experiments recorded in the present paper relate to *moist heat*—that is to say, the test-organisms have in every case been in a moist condition, in fluid cultures. The effect of dry heat upon desiccated organisms is quite another question. This has been studied by Koch and Wolffhügel,[1] who have summarized the results of their experimental work as follows:

"1. A temperature of 100° C. (212° F.), maintained for one hour and a half, will destroy bacteria which do not contain spores.

"2. Spores of mould-fungi require for their destruction in hot air a temperature of from 110°–115° C. (230–239° F.), maintained for one hour and a half.

"3. Bacillus spores require for their destruction in hot air a temperature of 140° C. (284° F.), maintained for three hours." (Op. cit., p. 231.)

In my experiments I have adopted ten minutes as the standard time of exposure to a given degree of temperature.

A fresh culture of the organism to be tested is introduced into capillary glass tubes which have an expanded extremity to serve as an air chamber, by means of which the culture fluid is drawn into or forced out of the capillary tube. This is readily accomplished by heating the little bulb.

The glass tubes, hermetically sealed, are introduced into a vessel containing water, which is kept at a uniform temperature by personal supervision, a Bunsen burner being the source of heat. A standard thermometer is placed in the vessel, and this and the capillary tubes are protected from the bottom of the vessel containing them by a thick plate of glass. A uniform temperature throughout the fluid is maintained by stirring it with a glass rod.

After exposure for ten minutes to a given temperature the sealed extremity of the capillary tube is broken off with sterilized forceps, and the contents are forced, by heating the air in the expanded extremity, into a test-tube containing sterile flesh-peptone-gelatine, which has been liquefied by exposure in a water bath to a temperature of 40° C., or below. The cotton plug is only removed for a moment in order to introduce the contents of the capillary tube, and in my extended experiments I have very rarely seen any accidental contamination. A rubber cap is next placed upon the open end of the test-tube and the gelatine is spread in a uniform manner over the interior of the tube by the method of Esmarch.[2] This is accomplished by rolling the tube in iced water until the gelatine hardens.

[1] Mitth. a. d. kais. Gesundheitsamte, Bd. 1.

[2] Zeitschrift für Hygiene, Bd 1, Heft 2, S. 293

These tubes are then kept at a temperature a little below the melting point of gelatine—20° to 22° C.—for at least a week. If the test organism has not been killed by the temperature to which it was exposed colonies are developed in the gelatine, which may often be recognized by the naked eye within a day or two. In other cases development is retarded, and it is only at the end of four or five days that evidence of growth is seen. The absence of growth at the end of eight or ten days is taken as evidence that the vitality of the test-organism has been destroyed by the temperature to which it was exposed. In every case a control experiment is made with material from the same culture which has not been subjected to heat.

Bacillus of Typhoid Fever.—Since the publication of Gaffky's memoir, in the second volume of the *Mittheilungen aus dem Kaiserlichen Gesundheitsamte*, his statements with reference to the formation of spores by the typhoid bacillus have been generally accepted, and have been confirmed by most of the observers who have followed him. Seitz,[1] however, has not been able to convince himself of the presence of spores in his cultures. Buchner[2] and Michael[3] also report their failure to find spores.

Gaffky states that spores are not formed at the room temperature, but that they are developed on the third or fourth day in cultures kept in an incubating oven at 37° C. These spores are said to be shining, round bodies, which occupy the whole width of the bacilli and are situated only at the ends of the rods. A single rod is said to contain but one well-developed spore, although, according to Gaffky, an imperfectly developed spore may sometimes be seen at the opposite end of a rod containing a perfect spore.

My cultures of the typhoid bacillus are from stock brought from Koch's laboratory by Dr. Meade Bolton. The morphological characters and the characteristic growth upon potato correspond perfectly with the account given by Gaffky and other authorities, and leave no doubt as to the identity of the organism which has served for my experiments. I have repeatedly seen in my potato-cultures which had been kept at 38° for several days, shining, spherical bodies, located at the ends of the rods, which appear to be spores, and which I suppose to be identical with the bodies pronounced by Gaffky to be spores. But these bodies stain with fuchsin, and if they are in truth reproductive elements, my temperature experiments show that their vitality is destroyed by a temperature of 60° C.

As my own previous experiments upon spore-bearing bacilli, and those of other experimenters, indicated that spores require for their destruction a comparatively high temperature, I made first the following ex-

[1] Bakteriologische Studien zur Typhus—Aetiologie, München, 1886.
[2] Archiv f. Hygiene, vol. iii. p. 361. [3] Fortschr. d. Medicin, 1886, No. 11.

periments, in which material from a pure culture in veal broth was exposed for the time adopted as a standard (ten minutes), as follows:

*Nov. 10.* **50°**, 60°, 70°, **Cont.**

In this, and in all subsequent records of experiments made, the figures in heavy type indicate that growth occurred; the figures in light type indicate the absence of growth—*i. e.*, the killing of the test organism by ten minutes' exposure to the temperature indicated by the figures. It will be seen that at 60° and at 70° C. no growth occurred, while in the control tube and in that at 50° (=122° Fahr.) the typhoid bacillus grew abundantly. My object has been to determine the lowest temperature which will insure the destruction of *all* germs of each species tested. I have not therefore considered it necessary to count the number of colonies which have grown out in the Esmarch tubes in those cases where the temperature has been insufficient to accomplish the object in view. Such a record has no special advantage over the simple record of growth or failure to grow. In the practical application of data of this kind to the disinfection of typhoid excreta, etc., it is evident that a few colonies, representing a few bacilli or spores, which have survived the temperature tested, are as potent for mischief as a larger number. My experiments upon the typhoid bacillus are recorded in the following table:

TYPHOID BACILLUS.

(Ten minutes' exposure.)

| Date. | Culture medium. | Experiments. | Remarks. |
|---|---|---|---|
| 1886. | | | |
| Nov. 10. | Veal broth. | **50°**, 60, 70, **Cont.** | In oven at 38° for 48 hours. |
| Nov. 15. | Veal broth. | **50°, 52, 54,** 56, 58, 60, **Cont.** | Fluid culture of November 1st. |
| Nov. 30. | Potato culture, | **50°, 55,** 60. 70, 80, **Cont.** | Culture at room temperature. |
| Dec. 4. | Potato culture, | 60°, **Cont.** | Culture in oven at 38° for 7 days. |
| Dec. 24. | Potato culture, | 60°, 70, 80, **Cont.** | Culture in oven for 10 days, then kept at room temperature for 15 days. |
| 1887. | | | |
| Jan. 15. | Potato culture, | 55°, 60, 70, 80, **Cont.** | Culture in oven at 38° for 7 days. |
| Jan. 20. | Potato culture, | **48°, 50, 52,** 60, **Cont.** | In oven at 38° for 10 days. |
| Jan. 21. | Potato culture, | **50°,** 60, **Cont.** | Potato in oven 7 days, then kept at room temperature 7 days. |

An inspection of this table shows that no development occurred in any instance after exposure to a temperature of 56° C. and above. In one experiment (Nov. 30) growth occurred after exposure to 55° C., but in this case it was very much delayed; in the experiment of January 15, no development occurred after exposure to 55°. Differences of this kind when we are on the border-line are to be expected.

We may then safely say that the thermal death-point of the typhoid bacillus is 56° C. (= 132.8° F.).

SPIRILLUM OF ASIATIC CHOLERA ("COMMA-BACILLUS" OF KOCH).—My experiments have been made simultaneously upon the cholera spirillum and the two organisms which most closely resemble it, viz., the "cheese spirillum" of Deneke and the Finkler-Prior spirillum.

The cultures in these experiments were all made at the room temperature in flesh-peptone-gelatine.

When development was retarded, the fact is indicated in the tables by a star following the figures denoting the temperature.

| Date. | Organism. | Temperature to which exposed ten minutes. |
|---|---|---|
| December 30, 1886 | Cholera spirillum. | 42°, 44, 46, 48*, Cont. |
| | Cheese spirillum. | 42°, 44, 46, 48*, Cont. |
| | Finkler-Prior spirillum. | 42°, 44, 46, 48*, Cont. |

In this first experiment no growth was observed in the Esmarch tubes containing the three organisms, after exposure to 48° for ten minutes, for several days afrer the control tubes had "broken down," but subsequently a few colonies developed in each of these tubes. This considerable retardation of growth led me to think that a slightly longer exposure would be fatal to all of these sprilla. I accordingly made the following experiment at the same temperature, but varying the time of exposure.

| Date. | Organism. | Temperature. | Time of exposure in minutes. |
|---|---|---|---|
| January 7, 1887 | Cholera spirillum. | 48° C. = 118.4° F. | 2°, 4, 6, 8*, 10*, 12*. |
| | Cheese spirillum. | " " " | 2°, 4, 6, 8*, 10*, 12*. |
| | Finkler-Prior spirillum. | " " " | 2°, 4, 6, 8*, 10*, 12*. |

This was followed by a similar experiment at 50° C.

| Date. | Organism. | Temperature. | Time of exposure in minutes. |
|---|---|---|---|
| January 10, 1887 | Cholera spirillum. | 50° C. = 122° F. | 2°, 4, 6, 8*, 10*, Cont. |
| | Cheese spirillum. | " " " | 2°, 4, 6, 8*, 10*, Cont. |
| | Finkler-Prior spirillum. | " " " | 2°, 4, 6*, 8, 10, Cont. |

In this experiment only a few colonies developed after exposure for eight and ten minutes in the case of the cholera and of the cheese spirillum, and none at all in the case of the Finkler-Prior spirillum.

The following experiment was made at 52° C.

| Date. | Organisms. | Temperature. | Time of exposure in minutes. |
|---|---|---|---|
| January 31, 1887 | Cholera spirillum. | 52° C. = 125.6° F. | 2°, 4, 6, 8, 10, Cont. |
| | Cheese spirillum. | " " " | 2°, 4, 6, 8, 10, Cont. |
| | Finkler-Prior spirillum. | " " " | 2°, 4, 6, 8, 10, Cont. |

It will be noted that identical results were obtained throughout with the cholera and the cheese spirillum, while the Finkler-Prior spirillum proved to have a little less resisting power to heat.

The following experiment gives a result in accord with the above. It was made for the purpose of testing the question whether a difference would be shown in the resisting power of old and recent cultures. I may remark here that the cholera spirillum retains its vitality for several months, at least, in cultures which are kept in a moist condition. On the other hand, Koch has shown that it is quickly destroyed by desiccation.

| Date. | Cholera spirillum. | Temperature | Time of exposure in minutes. |
|---|---|---|---|
| January 17, 1887 | Fresh culture. | 52° C. = 125.6° F. | 2°, 4, 6, Cont. |
| | Culture 13 days old. | " " " | 2°, 4, 6, Cont. |

ANTHRAX BACILLUS.—Davaine first made experiments (1873) to determine the temperature required to destroy the vitality of the anthrax bacillus as found in the blood of an animal just dead. Under these circumstances no spores are present. The destruction of vitality was tested by inoculation into susceptible animals. This method is open to the objection that at temperatures approaching that which destroys vitality the development of the bacillus is retarded, and the animal is likely to suffer a non-fatal attack of the disease, which may escape observation. This is probably the explanation of the slight difference in the results obtained by Davaine and those of Chauveau made more recently.

| Authority. | Temperature. | Time of exposure. | Remarks. |
|---|---|---|---|
| Davaine . . . . . | 48° | 15 minutes. | In blood. |
| Davaine . . . . . | 50 | 10 " | " " |
| Davaine . . . . . | 55 | 5 " | " " |
| Chauveau . . . . . | 50 | 20 " | Cultures. |
| Chauveau . . . . . | 54 | 10 " | " |

According to Flügge, anthrax spores are killed by exposure to 100° C. for two minutes. In a recent experiment by the writer a single colony developed after exposure to this temperature for two minutes, but there was no growth when the time was extended to four minutes.

BACILLUS OF GLANDERS—Löffler[1] has recently determined the thermal death-point of the *Rotz* bacillus. He finds it to be 55° C., the time of exposure being ten minutes.

BACILLUS OF SWINE PLAGUE (German, *Schweine rothlauf;* French, *Rouget*). BACILLUS OF MOUSE SEPTICÆMIA (Koch).—Pasteur's bacillus of *rouget* is, no doubt, identical with the bacillus of *Schweine rothlauf* of the German bacteriologists. I have experimented upon cultures from both sources. The bacillus of mouse septicæmia is also supposed by some authors to be identical with the above. According to Eisenberg, the bacillus of mouse septicæmia forms spores. Flügge says of the bacillus of *Schweine rothlauf:*

"In bouillon cultures which have been kept for three days at the room temperature, or for twenty-four hours at 40°, one notices the formation of small spherical bodies, which probably represent spores; although, on account of their minuteness, the formation and development of these bodies have not, up to the present time, been exactly observed."[2]

My experiments upon the thermal death-point of these organisms are included in the following tables.

CULTURES IN FLESH-PEPTONE-GELATINE.

| Date. | Organism. | Temperature to which exposed. |
|---|---|---|
| January 20, 1887 . . . . . | Mouse septicæmia. | 50°, 60, Cont. |
| January 26, " . . . . . | Mouse septicæmia. | 52°, 54, 56*, 58, Cont. |
| | Schweine rothlauf. | 52°, 54, 56, Cont. |
| February 7, " . . . . . | Mouse septicæmia. | 60°, Cont. |
| | Schweine rothlauf. | 60°, Cont. |
| February 8, " . . . . . | Mouse septicæmia. | 54°, 56*, 58, Cont. |
| | Rouget. | 52°, 54, 56*, 58, Cont. |

CULTURES IN BOUILLON.

| Date. | Organism. | Temperature to which exposed. |
|---|---|---|
| March 17, 1887 . . . . . | Rothlauf. | 60°, 65, Cont. |
| | Mouse septicæmia. | 60°, 65, Cont. |

These bouillon cultures were kept in the incubating oven at 38° for three days, and afterward at the room temperature for eight days. The bacilli were found to have grown out into slender filaments, which pre-

[1] Arbeiten a. d. Kaiserlichen Gesundheitsamte, Bd. 1, Heft 5. [2] Die Mikroörganismen, p. 246.

sented the appearance of having vacant places in their protoplasm, which possibly represented spores. As will be seen by reference to the table, no growth occurred after exposure to a temperature of 60° C. for ten minutes. We must, therefore, admit either that this bacillus does not form spores under the circumstances stated by Flügge, or that the spores are destroyed at the comparatively low temperature named.

In the following table I include several species of pathogenic and non-pathogenic bacilli in which the question of spore-formation has not been definitely settled. In regard to the first-named (Emmerich's bacillus) Eisenberg remarks "spore-formation not yet observed." According to Flügge, *B. sputig. crassus* "appears to form spores at a temperature of 35°." The bacillus of blue milk is said by Eisenberg to form spores in gelatine cultures after the third day. The lactic acid ferment is said by the same author to form spores at the ends of the rods, which appear as spherical, shining, highly refractive bodies. In my own examinations of stained cover-glass preparations from the cultures used in the following experiments, I have in no instance been able to satisfy myself of the presence of spores.

RECENT CULTURES IN FLESH-PEPTONE-GELATINE.

| Organism. | Date. | Temperature to which exposed ten minutes. |
|---|---|---|
| Emmerich's bacillus | January 24, | 60°, Cont. |
| | January 28, | 70°, 80, 90, 100, Cont. |
| | February 1, | 60°, 62, 64, Cont. |
| Brieger's bacillus | January 24, | 60°, Cont. |
| | February 1, | 58°*, 60*, 62°, Cont. |
| Friedländer's bacillus (So-called "pneumo-coccus.") | December 24, | 50°, 52*, 54*, Cont. |
| | January 8, | 58°, 60, 62, 64, Cont. |
| | January 11, | 54°, 56,* 58, Cont. |
| | January 20, | 56°, 58, Cont. |
| Bacillus sputig crassus (Kreibohm.) | January 24, | 60°, Cont. |
| | January 28, | 50°, Cont. |
| | January 31, | 54°, 56, 58, Cont. |
| Bacillus pyocyanus (Green pus.) | December 24, | 70°, 80, Cont. |
| | December 31, | 46°, 48, 50, Cont. |
| | January 8, | 58°, 60, 62, 64, Cont. |
| | January 17, | 52°, 54*, Cont. |
| | February 2, | 54°, 56, 58, Cont. |
| Bacillus indicus | January 21, | 56°*, 60, Cont. |
| | January 25, | 56°, 58, Cont. |
| | January 26, | 52°*, 54*, 56, Cont. |
| | February 2, | 54°, 56, 58°, Cont. |
| Bacillus prodigiosus (Commonly called micro-coccus prodigiosus.) | January 21, | 56°, 60, Cont. |
| | January 25, | 56°, 58, Cont. |
| | January 26, | 52°*, 54*, 56*, Cont. |
| | February 2, | 54°*, 56, 58, Cont. |
| Bacillus cyanogenus (Bacillus of blue milk.) | January 28, | 50°, 60, Cont. |
| | January 31, | 54°, 56, 58, Cont. |
| Bacillus fluorescens | January 28, | 50°, 60, Cont. |
| | January 31, | 54°, 56, 58, Cont. |
| Bacillus acidi lactici | January 24, | 60°*, Cont. |
| | January 26, | 52°, 54, 56, Cont. |
| | February 1, | 60°, 62, 64, Cont. |
| | February 8, | 54°, 56, 58, Cont |

### Potato Cultures in Incubating Oven for Three Days, at 38°, to Test for Spores.

(No spores seen on microscopic examination of stained cover-glass preparations.)

| Organism. | Date. | Temperature to which exposed. |
|---|---|---|
| Bacillus pyocyanus | March 1, 1887. | 60°, 65, Cont. |
| Emmerich's bacillus | " " | 60°, 65, Cont. |
| Brieger's bacillus | " " | 60°, 65, Cont. |
| Bacillus acidi lactici | " " | 60°, 65, Cont. |

### Old Cultures in Flesh-peptone-gelatine, to Test for Spores.

(March 7, 1887.)

| Organism. | Age of culture. | Temperature to which exposed. |
|---|---|---|
| Brieger's bacillus | 36 days. | 60°, 65, Cont. |
| Emmerich's bacillus | 43 " | 60°, 65, Cont. |
| Bacillus pyocyanus | 46 " | 60°, 65, Cont. |
| Bacillus fluorescens | 42 " | 60°, 65, Cont. |
| Bacillus cyanogenus | 33 " | 60°, 65, Cont. |
| Bacillus acidi lactici | 42 " | 60°, 65, Cont. |

It will be seen that in all of these experiments the lactic acid ferment is the only one which resisted a temperature of 60° C; and if the presence of spores could be determined by this test, this is the only organism in the list in which there is any evidence of spore formation. I am not, however, disposed to accept this test, and think it not improbable that some of the bacilli in the list form reproductive spores, which differ from those of the anthrax bacillus and certain other spore-forming bacilli, in the fact that they are destroyed at a comparatively low temperature. The only way to settle this question will be by the method of direct observation. If the refractive spherical bodies, supposed to be spores, which may be seen in potato cultures of the typhoid bacillus, in bouillon cultures of the bacillus of swine plague, etc., are observed to develop into bacilli, they will be demonstrated to be reproductive elements, or spores, notwithstanding the fact that they are destroyed by so low a temperature as 60° C.

The following experiments have been made with pathogenic and non-pathogenic bacilli which are known to form spores.

| Organism. | Date. | Temperature to which exposed ten minutes. |
|---|---|---|
| Bacillus alvei (foul brood of bees) | December 8,<br>December 30, | 80°, Cont.<br>90°, 100, Cont. |
| Wurtzel bacillus | January 24,<br>January 28, | 60°, Cont.<br>70°, 80, 90, Cont. |
| Bacillus butrycus | December 28,<br>December 31, | 80°, Cont.<br>90°, 100, Cont. |

The following experiments have been made upon these spore-forming bacilli at a temperature of 100° C. (212° F.). the time of exposure being varied.

| Organism. | Date. | Time of exposure in minutes. |
|---|---|---|
| Anthrax bacillus | February 9, | 2*, 4, 6, 8, 10, Cont.<br>* A single colony. |
| Bacillus alvei | February 9, | 2*, 4, 6, 8, 10, Cont.<br>* A few colonies. |
| Bacillus butrycus | February 9, | 2, 4, 6, 8, 10, Cont. |
| Wurtzel bacillus | March 4, | 2*, 4, 6, 8, 10, Cont.<br>* A single colony. |

BACILLUS TUBERCULOSIS.—Schill and Fischer (1884), assuming that the tubercle bacillus forms spores, made quite a number of experiments to determine its thermal death-point. Using fresh sputum as the material, and testing the destruction of the vitality of the bacilli contained in this material by inoculations into guinea-pigs, they found that exposure to a temperature of 100° C., in steam, was efficient when the time of exposure was five minutes. When the time was reduced to two minutes a negative result was obtained in two out of three guinea-pigs inoculated, but in one death from tuberculosis occurred.

My experiments upon micrococci are recorded in the following table.

RECENT CULTURES OF MICROCOCCI IN FLESH-PEPTONE-GELATINE.

| Organism. | Date. | Temperature to which exposed ten minutes. |
|---|---|---|
| Micrococcus of osteomyelitis | December 8, 1886.<br>December 20,<br>February 8, 1887. | 50°, 52, 54, 56, 58, Cont.<br>52°, 54, 56*, Cont.<br>54°, 56*, 58, Cont. |
| Staphylococcus pyog. aureus | January 11, 1887. | 54°, 56*, 58, 60, Cont. |
| Staphylococcus pyog. citreus | January 8, 1887.<br>January 11,<br>January 20, | 58°, 60*, 62, 64, Cont.<br>54°, 56, 58*, 60*.<br>56°, 58*, 60, Cont. |
| Staphylococcus pyog. albus | December 26, 1886.<br>January 11, 1887. | 52°, 54, 56*, Cont.<br>54°, 56, 58*, 60*. |
| Streptococcus erysipelatus | December 28, 1886.<br>January 20, 1887.<br>January 25, | 48°, 50, 52, Cont.<br>50°, 52, 58, Cont.<br>54°, 56, Cont. |
| Micrococcus tetragenus | January 25, 1887. | 54°, 56*, 58, Cont. |
| Micrococcus Pasteuri | March 29, 1887.<br>April 7, | 50°, 52, 54, 56, 58, Cont.<br>46°, 48, 50*, 52, Cont. |

FRESH CULTURES OF SARCINÆ IN FLESH-PEPTONE-GELATINE.

| Organism. | Date. | Temperature to which exposed. |
|---|---|---|
| Sarcina aurantiaca | December 24, 1886. | 56°, 58°, 60°, Cont. |
| | January 11, 1887. | 54°, 56, 58°, 60. |
| | January 18, | 58°, 60, Cont. |
| Sarcina lutea | December 29, 1886. | 56°, 58°, 60°, Cont. |
| | January 7, 1887. | 58°, 60°, 62°, 64, Cont. |
| | January 11, | 56°, 58, 60°, Cont. |
| | January 18, | 60°, 62, 64, Cont. |

GONOCOCCUS OF NEISSER.—Believing, as I now do, that this organism is the cause of the infectious virulence of gonorrhœal secretions (see *The Medical News* of Feb. 26, 1887), I have made the following experiment with reference to its thermal death-point. Some gonorrhœal pus from a recent case which had not undergone treatment, was collected for me by my friend, Dr. George H. Rohé, in the capillary tubes heretofore described. A microscopical examination of stained cover-glass preparations showed that this pus contained numerous "gonococci" in the interior of the cells. Two of the capillary tubes were placed in a water bath maintained at 60° C. for ten minutes. The pus was then forced out upon two pledgets of sterilized cotton wet with distilled water. Two healthy men had consented to submit to the experiment, and one of these bits of cotton was introduced into the urethra of each and left *in situ* for half an hour. As anticipated, the result was entirely negative. For obvious reasons no control experiment was made, and no attempt was made to fix the thermal death-point within narrower limits.

In connection with these experiments upon the thermal death-point of known pathogenic organisms, it is of interest to inquire whether the virulence of infectious material in which it has not yet been demonstrated that this virulence is due to a microörganism, is destroyed by a correspondently low temperature. Evidently, if this proves to be the case, it will be a strong argument in favor of the view that we have to deal with a microörganism in these diseases also. We have experimental proof that a large number of pathogenic organisms are killed by exposure for ten minutes to a temperature of from 55° to 60° C. But, so far as I am aware, this low temperature would not be likely to destroy any of the poisonous chemical products which might be supposed to be the cause of infective virulence—leaving aside the fact that such chemical products have no power of self-multiplication, and, therefore, could not be the independent cause of an infectious disease.

VACCINE VIRUS.—Carstens and Coert have experimented upon the temperature required to destroy the potency of vaccine virus. In a paper read at the meeting of the International Medical Congress, in 1879, they report as the result of their experiments that the maximum

degree of heat to which fresh vaccine can be exposed without losing its virulence, probably varies between 52° and 54° C.

RINDERPEST.—According to Semmer and Raupach,[1] exposure for ten minutes to a temperature of 55° C. destroys the virulence of the infectious material in this disease.

SHEEP-POX.—The authors last mentioned[2] have also found that the same temperature—55° C. for ten minutes—destroys the virulence of the blood of an animal dead from sheep-pox.

HYDROPHOBIA.—Desiring to fix the thermal death-point of the virus of hydrophobia, I obtained through the kindness of Dr. H. C. Ernst, a rabbit which had been inoculated, by the method of trephining, with material which came originally from Pasteur's laboratory (see Dr. Ernst's paper in the April number of this journal). The rabbit sent me showed the first symptoms of paralytic rabies on the eighth day after inoculation. It died on the eleventh day (March 2, 1887), and I at once proceeded to make the following experiment:

A portion of the medulla was removed and thoroughly mixed with sterilized water, the milky emulsion was introduced into four capillary tubes, such as had been used in my experiments heretofore recorded. Two of these tubes were then placed for ten minutes in a water bath, the temperature of which was maintained at 60° C. Four rabbits were now inoculated by trephining, two with the material exposed to 60° C. for ten minutes, and two with the same material from the capillary tubes not so exposed. The result was as definite and satisfactory as possible. The two control rabbits were taken sick, one on March 10, and one on the 11th; both died with the characteristic symptoms of paralytic rabies on the third day. The two rabbits inoculated with material exposed to 60° C. remained in perfect health. On the 26th of March one of these rabbits was again inoculated by trephining with material from the medulla of a rabbit just dead from hydrophobia. This rabbit died from paralytic rabies on the 8th of April. Its companion remains in perfect health.

A second experiment was made in the same way on the 14th of March. Two rabbits were inoculated with material exposed for ten minutes to a temperature of 50° C.; two with material exposed for the same time to a temperature of 55° C.; and two control rabbits with material not so exposed. One of the rabbits inoculated with material exposed to 50° C. and one of the control rabbits died on the 25th, the other rabbit inoculated with the material exposed to 50°, the other control, and one inoculated with material exposed to 55°, on the 26th. The second rabbit inoculated with material exposed to 55° died five days later with the characteristic symptoms of the disease.

These experiments show then that the virus of hydrophobia is

[1] Deutsche Zeitschrift für Thier med., vii. p. 347. [2] Ibid.

destroyed by a temperature of 60° C., and that 55° C. fails to destroy it—the time of exposure being ten minutes.

For convenience of reference the results obtained in my own experimental studies, and those of others referred to, are brought together in a single table. Where the determination has not been made by myself the authority is given in parentheses after the name of the organism. The time of exposure is ten minutes, unless otherwise indicated by figures in parentheses following those representing the temperature. The table includes those non-pathogenic organisms which have been tested as well as those which are recognized as pathogenic. In this table I have adopted the nomenclature used by Dr. Flügge in his recent work *Die Mikroörganismen*.

## Thermal Death-point of Microörganisms.

| Name of Organism. | Centigrade. | Fahrenheit. |
|---|---|---|
| Spirillum choleræ Asiaticæ | 52° | 125.6° (4 m.) |
| Spirillum tyrogenum[1] | 52 | 125.6 (4 m.) |
| Spirillum Finkler-Prior | 50 | 122 |
| Bacillus anthracis (Chauveau) | 54 | 129.2 |
| Bacillus typhi abdominalis | 56 | 132.8 |
| Bacillus mallei[2] (Löffler) | 55 | 131 |
| Bacillus of schweine-rothlauf (Rouget of Pasteur) | 58 | 136.4 |
| Bacillus murisepticus | 58 | 136.4 |
| Bacillus Neapolitanus[3] | 62 | 143.6 |
| Bacillus cavicida[4] | 62 | 143.6 |
| Bacillus pneumoniæ[5] | 56 | 132.8 |
| Bacillus crassus sputigenus | 54 | 129.2 |
| Bacillus pyocyanus | 56 | 132.8 |
| Bacillus indicus | 58 | 136.4 |
| Bacillus prodigiosus | 58 | 136.4 |
| Bacillus cyanogenus | 54 | 129.2 |
| Bacillus fluorescens[6] | 54 | 129.2 |
| Bacillus gallinarum (Salmon)[7] | 56 | 132.5 |
| Bacillus acidi lactici[8] | 56 | 132.8 |
| Bacillus alvei; spores | 100 | 212 (4 m.) |
| Bacillus anthracis; spores | 100 | 212 (4 m.) |
| Bacillus butrycus; spores | 100 | 212 (4 m.) |
| Bacillus mycoides; spores | 100 | 212 (4 m.) |
| Bacillus tuberculosis (Schill and Fischer) | 100 | 212 (4 m.) |
| Staphylococcus pyogenes aureus | 58 | 136.4 |
| Staphylococcus pyogenes citreus | 62 | 143.6 |
| Styphylococcus pyogenes albus | 62 | 143.6 |
| Streptococcus erysipelatus | 54 | 129.2 |
| Micrococcus tetragenus | 58 | 136.4 |
| Micrococcus Pasteuri | 52 | 125.6 |
| Micrococcus gonorrhœæ[9] | 60 | 140 |
| Sarcina lutea | 64 | 147.2 |
| Sarcina aurantiaca | 62 | 143.6 |
| Vaccine virus (Carstens and Coert) | 54 | 129.2 |
| Rinderpest virus (Semmer and Raupach) | 55 | 131 |
| Sheep pox virus (Semmer and Raupach) | 55 | 131 |
| Hydrophobia virus | 60 | 140 |

[1] Cheese spirillum. [2] Bacillus of glanders. [3] Emmerich's bacillus.
[4] Brieger's bacillus. [5] Friedländer's. [6] From water.
[7] Pasteur's "microbe du cholera des poules."
[8] Old culture in flesh-peptone-gelatine not killed by 60°, probably owing to the presence of spores.
[9] A single experiment. A lower temperature would probably be effective.

By reference to the various tables giving the experimental data in detail, it will be seen that the results are not absolutely uniform for the same organism. Thus, in the experiments upon the typhoid bacillus no growth occurred after exposure to 55° in one experiment (January 15), while in another (November 30) colonies of the typhoid bacillus grew out after exposure to this temperature. In this case the thermal death-point is placed at 56°, no growth having occurred after exposure to this temperature. Similar differences, when the temperature approaches that which is uniformly successful in destroying vitality, may be observed with reference to several of the organisms tested. But these differences are within comparatively narrow limits. They are probably due partly to a difference in resisting power depending upon the age of the culture, and partly to unavoidable variations in the temperature during the experiments. By very careful supervision and frequent stirring of the water-bath, variations in temperature have been kept within narrow limits, but it has been impossible to avoid them entirely. The same thermometer has been used throughout (made by Schlag and Berend, Berlin).

No attempt has been made to fix the thermal death-point within narrower limits than 2° C., and in the above table the lowest temperature is given which has been found, in the experiments made, to destroy all of the organisms in the material subjected to the test. No doubt more extended experiments would result, in some instances, in a reduction of the temperature given as the thermal death-point for a degree or more. But the results as stated are sufficiently accurate for all practical purposes, and permit us to draw some general conclusions:

(*a*) The temperature required to destroy the vitality of pathogenic organisms varies for different organisms.

(*b*) In the absence of spores, the limits of variation are about 10° Centigrade (18° F.).

(*c*) A temperature of 56° C. (132.8° F.) is fatal to the bacillus of anthrax, the bacillus of typhoid fever, the bacillus of glanders, the spirillum of Asiatic cholera, the erysipelas coccus, to the virus of vaccinia, of rinderpest, of sheep-pox, and probably of several other infectious diseases.

(*d*) A temperature of 62° C. (143.6° F.) is fatal to all of the pathogenic and non-pathogenic organisms tested, in the absence of spores (with the single exception of *sarcina lutea*, which, in one experiment, grew after exposure to this temperature).

(*e*) A temperature of 100° C. (212° F.) maintained for five minutes destroys the spores of all pathogenic organisms tested.

(*f*) It is probable that some of the bacilli which are destroyed by a

temperature of 60° C. form endogenous spores which are also destroyed at this temperature.[1]

The experimental study, the results of which are recorded in the present paper, was made, through the courtesy of Prof. Wm. H. Welch, in the pathological laboratory of Johns Hopkins University.

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## A CONSIDERATION OF THE RESULTS IN 327 CASES OF TRACHEOTOMY,

### PERFORMED AT THE BOSTON CITY HOSPITAL FROM 1864 TO 1887.

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The operation of tracheotomy was performed for croup 327 times at the Boston City Hospital from the time of its foundation in 1864 to January, 1887. Up to the year 1880, only 30 tracheotomies had been done, so that the greater part of the operations have been performed in the last six years. It should be noted, in passing, that a bad class of cases would naturally come to a city hospital for operation. In most instances being treated at home, medically, until an operation has become imperative and long after it has become advisable, they are brought hurriedly for operation often in a hopelessly bad condition. If the parents wish or if an operation seems likely to afford even temporary relief to the patient, tracheotomy is performed, and thus many hopeless cases are yearly operated upon; all of which are included in the analysis. We are indebted to the visiting surgeons of the hospital for permission to publish the following cases.

Of the 327 cases, 232 died and 95 (29.05 per cent.) recovered. The causes of death were, septicæmia in 62 cases, extension of the diphtheritic process to the trachea and bronchi (doubtless including many pneumonia cases) in 101 cases, exhaustion in 12 cases, death on the table in 10 cases, heart failure in 6 cases, various causes (pneumonia, peritonitis, scarlet fever, nephritis, embolism, marasmus) in 6 cases, undetermined in 35 cases.

Autopsies were so few that a clinical estimate of the cause of death had to serve in most cases; such a classification is approximate at best and the distinctions were by no means always clear. When death was preceded by gradually increasing dyspnœa it was considered that exten-

[1] This question demands further experimental investigation.

sion of the diphtheritic process to the bronchi was the cause of death and the truth of this was often proved by autopsy. In other cases profound septic poisoning was evident as the chief cause of death. These are the two great classes into which the majority of cases fall, other causes of death seeming incidental. Children with septicæmic symptoms died more quickly after operation than those dying by extension of the process to the bronchi. An average of the two classes showed that septicæmic patients died on the average two days after operation, while children dying by extension lived three days.

The relation of the number of deaths from extension to those from septicæmia is shown below.

| | Extension. | | Septicæmia. |
|---|---|---|---|
| In all the fatal cases . . . . . | 1⅞ | to | 1 |
| In children under 2 years . . . . . | 3¼ | to | 1 |
| In children from 2 to 10 years . . . . | 1¼ | to | 1 |

It can be seen from this that young children are particularly liable to that distressing cause of death, extension of the process to the bronchi. When this happens there is no euthanasia, death is the slowest and most painful of suffocations, and only when septicæmia to the point of stupefaction is present at the same time does the child escape a horrible amount of suffering. The frequency of this painful ending then is not to be lost sight of in recommending the operation as a means of euthanasia, especially in children under two years of age.

10 cases died on the table. 2 of these evidently died of heart failure, for they stopped breathing before the trachea was opened and had but slight hemorrhage. 4 had profuse hemorrhage, and 2 died of shock some little time after the tube was put in place and everything seemed favorable. In the remaining 2 cases the records are not full. The 6 cases classed as heart failure did not die on the table, but from the first to the fifth day after operation.

An attempt was made to find the ultimate result in the 95 patients that recovered. 23 cases recovered in 1886, and were considered as too recent to be of value.

Of the 72 that recovered previous to January, 1886, 56 have been personally investigated, while 16 could not be found. The research was made especially difficult by the fact that it was so common for the parents to move after an attack of diphtheria and the consequent investigation by the Board of Health. Of the 72 families, 57 had moved at least once. 15 cases were seen from one to two years after operation; 16 cases in three years; 12 cases in four years; 2 cases in five years; 6 cases in six years; 4 cases in seven years; 1 case in twenty-one years. 26 have never been ill in any way since recovery from the operation.

7 have had pneumonia, measles, or mumps, but have fully recovered, no one of them having had croup at the time of illness. 2 have had diphtheria a second time without laryngeal complication; 1, nine years old, two years after operation, and 1, twenty years old, four years after.

With eight exceptions, the patients have been free from any attack of croup since operation. One, five years old, operated on in 1885, has had two attacks, one of which was quite severe. One, ten years old, operated on in 1884, has had one or two attacks, and is in poor general condition. One, four years old, operated on in 1885, is apt to be croupy with a slight cold. One, six years old, operated on in 1885, the same. One, fourteen years old, operated on in 1883, the same. One, ten years old, operated on in 1885, has croupy cough. One, seven years old, operated on in 1884, was liable to be croupy for a while after operation, but is not so now. One, eleven years old, operated on in 1883, the same.

Of complications coming after operation, one had nephritis and paralysis, but recovered; one had nephritis for four months. One had "abscesses." One, a boy ten years old, operated on in 1881, could not blow his nose for two years, but is well now.

There have been no deaths in the 56 cases investigated, and there is no reason to believe that these are any more favorable than the 16 that could not be found.

As to present condition, 53 may be said to be in good general health: 10 to 15 are said to take cold more easily than before. That it is not a very serious matter may be seen by the fact that only 6 are said to be liable to sore throats, of whom 2 have tonsillitis at times, and the remainder are liable to have sore throats when they catch cold. Of the 3 who were found not to be in good condition, one, six years old, operated on a year and a half ago, has phthisis, but no laryngeal symptoms. The second, noted above, is in bad general condition, hoarse, and croupy. The third is a delicate boy, five years old, with no positive signs of trouble except a tendency to croup and illness.

The voice is clear in all but 4 cases; in one of the latter, a girl of thirteen, operated on two years ago, the voice is not so clear as before operation, and she cannot sing so high as before. The second, four years old, has a fairly clear voice, but it is said to be less so than before operation, two years ago; two are said to be hoarse when they have slight colds. The scars in all cases are healed and are more or less conspicuous according to the severity of the original wound; none were found adherent, and in no instance had the scar travelled downward toward the sternum as mentioned by Neukomm.[1] In nearly all the cases a linear depression in the trachea admitting the edge of the finger-nail could be

[1] Neukomm: Centralb. f. Chirurg., 1885, No. 38.

felt at the site of the original wound, but in one case operated on in 1880, by the low operation, no nick was felt in the trachea.

There were 4 cases of stenosis which are noted later in the article.

It has been stated that[1] the operation tends to become less fatal in any place as the years go by. In Berlin[2] the death-rate after operation fell 22 per cent. in six years, and in Paris,[3] at the Hôpital des Enfants Malades, it fell nearly 30 per cent. in six years.

In 11,696 cases reported by Agnew,[4] in 1878, the recovery per cent. was 26.25. In 1137 cases reported since then which were grouped merely for comparison on this point, the recovery rate was 33.8 per cent. But in the present series of cases no such result was noted. From 1881 to 1885 the recovery per cent. fell from 35 to 26; in 1886 it rose again to 29, but the general tendency has been downward, a fact which is probably dependent on the extension of the operation to more and more hopeless cases each year. Moreover, Wanscher,[5] in Copenhagen, in several years noted no such falling off in the fatality per cent. Statistics definite enough to clear up the point are too few.

It became apparent while studying the cases that there was a marked variation in the proportion of recoveries at the different seasons of the year. Therefore, a calculation was made of the average monthly mortality per cent. in each of the twelve months for five years preceding 1886, and the result is shown graphically in Table I. It will be seen that in the winter months the smallest proportion of cases recover, not 20 per cent. in December, February, and March, while from the latter month the recovery rate rises until July, when about 60 per cent. of all cases operated on get well. In a general way, each year showed the same tendency when considered by itself. As a matter of interest, the per cent. of mortality from diphtheria in the city at large was calculated by the month for the same five years from the tables of the Board of Health,[6] and a very striking correspondence was noticed. The diphtheria mortality per cent. curve is shown in Table IV.

To see if the tracheotomy mortality per cent. bore a similar relation to other zymotic diseases than diphtheria, the monthly mortality per cent. of scarlet fever (chosen only as a representative) for the same five years was calculated for the whole city, and the result is shown in Table VII.

By comparison of these three tables it will be seen that from 1881 to 1885 inclusive, the tracheotomy death-rate at the Boston City Hospital

[1] Hugonnai: Das erste 100 Croup Operationen in Zürich. Inaug. Diss., Zürich, 1878.

[2] Krönlein: Archiv f. klin. Chir., Bd. xxi. Heft 2.

[3] Bourdillat: Bull. et Soc. Méd. Hôp. Paris, 1867, 39.

[4] Agnew: System of Surgery, vol. iii.

[5] Wanscher: Om Diphtheritis og Croup saerlight med. Hyensyen til Tracheotomien ved Samme for Doctor graded i Medicinen. Kjoebenhavn, 1877.

[6] Reports of the Boston Board of Health, 1881–85.

varied by the month in the closest correspondence to the mortality per cent. of diphtheria for the same time in the whole city of Boston, and that it did not vary at all in correspondence with the death-rate from scarlet fever in the whole city. Nor does it correspond to the general monthly mortality of the city for all diseases during the same five years. In a word, when diphtheria is most fatal in the city, tracheotomy is most fatal at the hospital. That this variation is not due to the greater prevalence of scarlet fever or diphtheria at different seasons is shown by Tables II. and V., which show the monthly number of cases reported for the five years of each disease. It is also of much interest to see how closely the number of deaths from croup and diphtheria in the whole city correspond when considered by the month in the same way. (Table III.) The same correspondence was noted for 1876–77 by Dr. F. W. Draper.[1]

It does not come within the scope of this paper to enter upon any discussion as to the identity of croup and diphtheria; at the same time it is easy to see that the correspondences and variations noted above lend a very strong weight to the assertion that croup and diphtheria are one and the same disease. However it may be in other places, idiopathic, non-diphtheritic croup is very rare in Boston; whether it exists at all is questioned by many. The overwhelming majority of all cases coming for operation to the hospital present some signs of diphtheritic infection, membrane in the throat or nose, enlarged glands in the neck, albuminuria, septicæmia, and the like.

If the seasonal death-rate from diphtheria in a city affects the tracheotomy death-rate so much as our tables would seem to show, we should expect that in cities where a low death-rate from diphtheria prevails unusually favorable results would follow tracheotomy. And this may account for the otherwise inexplicable figures given by Wanscher, of Copenhagen, where of 400 cases operated on in hospital practice 42 per cent. recovered. The table shows the rest.

| | To the 1000 of the living population. |
|---|---|
| General death-rate in Copenhagen, 1880–1885 . . . | 22.8 |
| General death-rate in Boston, 1880–1885 . . . . | 22.5 |
| Diphtheria death-rate in Copenhagen, 1880–1885 . . | 0.25 |
| Diphtheria death-rate in Boston, 1880–1885 . . . | 1.35 |

Unfortunately, statistics are not to be obtained for similar investigation in other cities.

The presence of membrane in the pharynx is by no means an invariable accompaniment of the laryngeal trouble, for it was noted as having been present in the pharynx in 158 cases and absent in 93, while in 76 there was no definite note. It was undoubtedly seen but not noted in

[1] Reports of Boston Board of Health, 1877–78.

many cases, whereas nearly every case in which it was absent was probably entered in the notes, so that the figures given above by no means represent the true proportion. But the interest of the two classes of cases lies in the difference of their death-rates. Of the 158 cases where membrane was present in the pharynx at the time of operation 44 or 28 per cent. recovered, in the 93 cases where membrane was absent from the pharynx 37.6 per cent. recovered.[1] That this difference in the per cent. is not due to the fact that the cases where membrane was absent were older children, is shown by the average age of the two classes:

Where membrane was present the average age of the 158 cases was 4.4 years.

Where membrane was absent the average age of the 93 cases was 4.1 years.

That is, in spite of the fact that the children were younger, 10 per cent. more recovered where membrane was not present in the pharynx at the time of operation.

In the majority of cases the attack of croup had been preceded by illness varying from one to seven days in duration. Oftenest there was the history of an attack of pharyngeal diphtheria preceding, but sometimes there had only been a day or so of general malaise without definite throat symptoms. In an average of 225 cases the attack of croup came on the fifth day of the illness, and in only 10 cases was the croup not preceded by at least one day's illness.

Perhaps the most important question of all is the influence of early or late operation as it affects recovery, as it is one of the very few conditions under the control of the surgeon. The table shows the recovery-rate in cases operated upon within one, two, three, and four days after the beginning of the obstructed respiration.

| Day of operation. | Number of cases. | Recovery. | Per cent. of recovery. |
|---|---|---|---|
| 1 | 123 | 40 | 32.5 |
| 2 | 86 | 24 | 28.0 |
| 3 | 33 | 8 | 25.3 |
| 4 | 7 | 1 | 14.0 |

In the same line of argument the amount of the patient's dyspnœa at the time of operation serves to advocate the performance of tracheotomy while the dyspnœa is yet moderate. In 154 cases the dyspnœa before operation was noted as "severe;" of these, 21 per cent. recovered. In 124 where it was noted as "moderate," 35 per cent. recovered. The argument against early operation is of course the possibility of a patient's recovery from even severe dyspnœa without tracheotomy; on this point

[1] Honsell: Aerztl. Mittheil. aus Baden, xxxvi., 1882.

authorities differ very widely. Steiner[1] has seen only three recoveries of this sort. Mackenzie[2] sets the death-rate without operation at 90 per cent., and in 33 cases of croup treated medically many years ago by Dr. John Ware,[3] 30 died. On the other hand are arrayed Lewis Smith,[4] Meigs and Pepper,[5] and Agnew,[6] who believe that recovery without operation is more frequent than has commonly been supposed. The experience at the City Hospital has been as follows: forty cases of diphtheritic croup have been treated medically and every one died. Dr. G. W. Gay, visiting surgeon, wrote in 1885,[7] "Not a single case of pseudo-membranous laryngitis has ever recovered in this hospital without operation." And he quoted Dr. D. W. Cheever, senior visiting surgeon, as writing to him in 1884,[8] "After reflection I cannot recall a case of membranous laryngitis that I have known to recover without tracheotomy." Since Dr. Gay's article was written there have been two recoveries from moderate dyspnœa without operation.

The age of the patient is, of course, an important consideration, the mortality-rate falls as the age increases, up to eight or ten years. In 1600 cases collected from Cohen,[9] Schüller,[10] Birnbaum,[11] Mastin,[12] etc., and tabulated with regard to the age of the patients, the recovery-rate in children less than two years old was 20 per cent., rising steadily until the age of eight years was reached, when it was 40 per cent. The 327 cases reported here followed much the same course, except in the youngest children, where the operation proved much more fatal. Of 42 patients under two years of age only 3 recovered, 1 eleven months old, and 2 fifteen months old, all nursing children. The oldest case to recover was a girl sixteen years old, and several adults died.

There are several minor symptoms that deserve mention. Nasal discharge was almost always present and had no special significance. When it was associated with severe septicæmia it was ordinarily foul-smelling. Cervical glandular swelling, in the same way, was generally present, being noted as absent in only 24 cases. It was present in all sorts of cases, and its only significance was that when it gradually increased after operation, death from septicæmia followed in an overwhelming majority of cases. To be sure, two or three cases got well after having developed an amount of glandular swelling that made the neck

[1] Steiner, quoted by Gay: Wood's Ref. Handbook of Med. Sci, vol. ii. p. 344.
[2] Mackenzie: Diseases of the Throat and Nose.
[3] Ware, quoted by Gay, Ibid.
[4] Lewis Smith: Dis. of Children, Phila., 1881; also Amer. Journ. of Med. Sci., April, 1885, p. 319.
[5] Meigs and Pepper: Diseases of Children.
[6] Agnew, loc. cit.
[7] Gay: Wood's Ref. Handbook of Med. Sci., vol. ii. p. 344.
[8] Gay: Phila. Med. News, July 12, 1884.
[9] Cohen: Croup in its Relation to Tracheotomy, 1884.
[10] Schüller: Deutsche Chir., Lief 37, Stuttgart.
[11] Birnbaum: Arch. f klin. Chir., xxxi. p. 333.
[12] Mastin: Gaillard's Med. Journ., xxix. 1 p. 1.

double its ordinary size, but in general when the neck tape had to be loosened, after it was once tied in place, it meant death for the patient.

Albumen was present in the urine of five-sixths of all the cases in which an examination was made and recorded (75 in number). It appeared in all classes of cases and was particularly abundant in bad cases of septicæmia. Sugar was temporarily present in the urine of one child who recovered.

The discharge from the trachea tube after operation furnished perhaps the most important indication of a patient's progress. The discharge was classified as loose and as gummy, and the line between the two classes was easy enough to draw ordinarily. The inner tube was always taken out and cleaned every two or three hours, and at these times the character of the discharge taken from it was noted. Sometimes there was no discharge at all, and then the case was classed as "discharge suppressed;" when it was gummy it was always scant. The importance of the tube discharge with reference to the prognosis of the cases is shown in the following table:

| | Number of Cases. | Number of Recoveries. | Per cent. |
|---|---|---|---|
| When the discharge was loose throughout . . . . . | 83 | 53 | 60 |
| When the discharge was gummy at any time, even temporarily . . . | 86 | 11 | 13 |
| When the discharge was suppressed . | 15 | 0 | 0 |

The notes were indefinite in the other 143.

The appearance of blood in the tube discharge was a matter of no significance. It was always present for a while after operation and reappeared in all classes of cases at irregular intervals, sometimes as late as the fifth day after operation.

The temperature possessed no more than its usual significance in acute febrile diseases; when it rose higher than 105° at any time the child rarely recovered. The temperature generally rose several degrees after operation, but it was of no significance unless, as pointed out by Ripley,[1] it remained high, when it could be inferred that the disease was progressing unfavorably. But a marked rise on the third, fourth, or fifth day after operation was the most ominous sign and generally ushered in a fatal result. In the majority of cases the temperature ranged between 99° and 103°.

The treatment in all these years has, of course, varied very much. Of late years the steam pipes in the tracheotomy rooms have been tapped, and for several days after operation every child lies in a cloud of steam coming from these pipes. In former years a hand atomizer was used. Free stimulation and milk *ad libitum* form the treatment of

[1] Ripley: Med. Record, Jan. 24, 1885.

nearly all cases after operation. 66 cases were treated with mercury in small and frequent doses ($\frac{1}{60}$ of a grain of corrosive sublimate or $\frac{1}{4}$ of a grain of calomel every two hours), and the recovery per cent. was 28, and did not differ materially from the recovery per cent. of 156 cases which were treated by steam, brandy, and milk, where 40 cases, or 25 per cent., got well. Quinine was given through the course of the disease in 53 cases, and the recovery per cent. here was 39, much larger than in the other cases mentioned above, but the numbers are altogether too small to warrant any conclusions as to the comparative efficacy of different methods of treatment.

In turn, ipecac, lime-water spray, chlorate of potash, iron, pilocarpine, pepsine, etc., have held the chief place, but the number of cases in which each has figured is too small to be worth analyzing, and iron, quinine, and mercury hold the chief places. In connection with the mercurial treatment, it should be mentioned that an excessive flow of saliva is an occasional accompaniment of laryngeal diphtheria. This was noted in several cases in which mercury was not used at all, and for that reason the drug is probably credited with much salivation for which it is not accountable. In the same way diarrhœa, many times noted after the continued use of calomel in $\frac{1}{4}$ grain doses, often came on where no mercurial had been administered. Young children took $\frac{1}{60}$ of a grain of corrosive sublimate for two or three days, and within that limit they were rarely salivated, and still more rarely did they have diarrhœa. If it was continued longer, or if it was given in larger doses, it was apt to cause one or both. Calomel, on the other hand, was likely to cause diarrhœa, if used even moderately.

When a patient progressed well, on the fifth, sixth, or seventh day the neck tape was cut, and the tube was taken out quietly, without any preliminary testing of the larynx by stopping the tube. In 65 cases of the 95 which recovered, the tube was finally removed by the eighth day (once on the third day, and twice on the fourth), and was not replaced. In 9 cases it was necessary to put back the tube within a few hours of its first removal, and to leave it for a few days more, on account of the difficulty which the child experienced in breathing without the tube. In 4 others it had to be replaced a second time, but it was not worn more than a month altogether in any one of them, while in 4 others it was impossible to remove the tube definitely for periods varying from 3 months to 3 years. These four cases have been reported elsewhere.[1] This difficulty in getting the children to breathe without their tubes at the usual time for so doing did not seem to be due to any unusually early or late time of the first attempt at removal. In most of them, as in the others, the attempt at removal

[1] Lovett: Boston Med. and Surg. Journal, July 22, 1886.

was made on the fifth, sixth, or seventh day, and not until the dyspnœa began (usually some hours after the tube was taken out) was there any indication that matters were to go wrong. These were average cases in every other way.

Diphtheria of the wound was noted in only 6 cases in the 327; 3 of these recovered. In 2 other cases diphtheritic membrane appeared, once on the ear, and once on the lip.

17 times the tracheotomy was done for croup (mostly diphtheritic in type) occurring during the course of the exanthemata, mumps, or whooping-cough. In 10 cases it was a complication of measles, and of these cases 5 recovered. A very unusual state of affairs, if we may believe Cohen,[1] who says, "Croup supervening on the exanthemata is not, as a rule, amenable to tracheotomy," and Settegast[2] says "Cases of recovery are so rare as to be mentioned individually." The other 7 cases after mumps, scarlet fever, and whooping-cough were all fatal.

The amount of nourishment taken by a patient indicated, of course, in a general way the progress of the case. The children were encouraged to take as much milk as possible, and in many cases were fed every hour. They took from 20 to 40 ounces of milk a day, 30 was a fair amount, and when a child took less than 25 it rarely recovered. Milk came out through the tube and wound in some cases, but it was no very serious matter, for in 7 cases when it was noted, 5 recovered. There were many curious complications in all these cases, but those of practical interest have already been mentioned.

The results of operation in this series of cases are above the average, in spite of the predominance of bad cases. They show that young children are especially liable to have extension of the diphtheritic process to the bronchi and lungs; in fact, that the chances are three to one that if they die they will die of suffocation. That, in Boston, tracheotomy at the hospital is most fatal at those times when diphtheria is most fatal in the whole city, and incidentally that the mortality per cent. from croup and diphtheria in the whole city vary by the month in unison. That cases with membrane in the pharynx at the time of operation are more likely to die than those where it is not present. That the mortality per cent. after tracheotomy rises steadily as the operation is done on the first, second, third, or fourth day of the difficult breathing. That nasal discharge, albuminuria, and enlargement of the cervical glands, are symptoms of less moment than the character of the discharge from the trachea tube, which is the most important index of the progress of a case, and that the recovery-rate varies nearly 50 per cent. between cases

[1] Cohen: Croup in its Relation to Tracheotomy. 1874.
[2] Settegast: Archiv für klin. Chir., xxiii. 270.

where the discharge is loose throughout and those where it is gummy at any time.

For purposes of comparison, a table of all available reported cases of tracheotomy has been constructed. As a rule, no group of less than five operations has been considered, very few contain less than ten, for the reason that recoveries predominate enormously in the very small groups. The journals are full of accounts of two or three successful cases reported by practitioners who may or may not hint at various failures in the past. It was considered that to count such groups would be misleading, and they were all rejected, whether favorable or not, because they were not considered representative. The cases are arranged by countries, and, so far as it has been possible to tell, no cases have been reported more than once.

| | Total. | Recovered. | Died. | Per cent. Recovered. |
|---|---|---|---|---|
| German authors | 5795 | 1851 | 3944 | 31 |
| German hospitals | 3063 | 939 | 2124 | 30 |
| British authors | 433 | 138 | 295 | 31 |
| French authors | 9242[1] | 2242 | 6834 | 24 |
| Various countries | 1993 | 657 | 1336 | 32 |
| American authors | 1327 | 308 | 1019 | 23 |
| | 21,853 | 6135 | 15,552 | 28 |

[1] 166 not healed.

# REVIEWS.

THE SCIENCE AND ART OF OBSTETRICS. By THEOPHILUS PARVIN, M.D., LL.D., Professor of Obstetrics and Diseases of Women and Children in the Jefferson Medical College, Philadelphia, and one of the Obstetricians to the Philadelphia Hospital. Illustrated with two hundred and fourteen woodcuts and a colored plate. Pp. xv. 701. Philadelphia: Lea Brothers & Co., 1886.

THERE is always room for a good book. The more thoroughly beaten are the paths, the more familiar each commanding feature of the landscape, the better welcome to one that can picture anew the familiar scene, and throw upon it broader lights or bolder contrasts. But where so many know, and so many have described it, all the more difficult for one to enter upon the field. He must expect criticism. No two see the same well-known object from the same point of view. The perspective angles are all different. In the great field of gynecic literature obstetrics seems to stand still. It is not still, however. It has the advance that is made all along the line, and has seemed to move less rapidly in contrast to the brilliant progress of gyniatrics.

There is enough of the new to signalize the advent of a new book in obstetrics, and it is a graceful act in Dr. Parvin to mark his translation from his old field of work in the West to one of broader, more ardent labor in the East by an elaborate treatise upon a subject that he has made his own, and won an honorable fame.

His task has been a difficult one, and to which he must have been impelled by a higher motive than ambition. We needed the book, not in the sense of lack of quantity before the medical public from which to select, but American literature upon obstetrics is not yet rounded out and complete in all its proportions. Dr. Parvin contributes much to complete the structure, and we may now begin to say that we have upon the subject a national literature. Upon a science so broad as obstetrics it may be difficult to define how, in any sense, it can be national in character. This is no place to discuss the matter; but the literature upon that or any other subject may be of such a broad and original character as to afford a consensus of opinion that is truly national. We may go even further, and assert, without danger of inviting contradiction, that environment and social condition may exist as prime factors in modifying to a degree equal to national characteristics many of the phenomena of that science called obstetrics.

Dr. Parvin begins his treatise in the good, old classical way of grounding his readers in elementary anatomy and embryology. A departure from this order would, by some reviewers, be regarded as an innovation. but we believe that some obstetrical author of the future will thus innovate. It is perfectly proper to regard the young obstetrical reader as being in need of some special instruction concerning the female pelvis and

its contents, but one must be careful not to do the young reader harm rather than good. Dr. Parvin takes a cut from a plate by Sappey of the situation and relations of the uterus, in which the uterine axis is made to conform to the axis of the upper pelvic strait, except that the uterine fundus is slightly posterior to the line of the latter. As usual in this time-honored illustration the bladder and rectum are in a distended condition. The reader may protest against the notice of such a trifle, but it is not by any means a light matter. The mass of students and practitioners have not original and costly monographs within reach to correct an error of this sort, especially as all the text-books upon diseases of women in English, with one honorable exception, reproduce an illustration of the same general character. The reviewer well remembers that once upon a time, while giving evidence upon the stand, an unfriendly advocate held Playfair's very good book under his gaze with this same cut, or one like it, uppermost, and asked him if that was a correct illustration of the natural relation of the pelvic viscera. "No, sir, it is not," was promptly answered. "What!" with a triumphant glance at the jury, "do you differ from this distinguished English authority, and from Dr. A., and Dr. B., who have just sworn that this is a correct representation of these parts?" Surely this advocate could not be blamed, nor could Dr. A., or Dr. B. But we must confess to a certain degree of feeling toward Playfair, who knew better, and one may fancy that the well-executed woodcut in Parvin will serve the same ignoble end. Our author still further confuses his younger readers by giving an approximately correct pelvic section copied from Schultz, without a word of comment to guide the reader to a correct conclusion. The two opening chapters devoted to the subject already noticed are well illustrated, and compiled from the latest authority. We notice but one omission, and that is the correction of Hart, as to the distribution of mucous membrane upon the nymphæ and body of the clitoris, which differs materially from accepted descriptions, which independent study by others has confirmed.

The third chapter upon puberty, ovulation, and menstruation is interestingly written. At the outset our author expresses himself in a way that one choice in the use of terms would object to. Incidentally he defines menstruation as a hemorrhage from the uterus that occurs at definite times, concerning which, we all know that menstruation in its normal expression is not a hemorrhage. Justice requires us to admit that he does not use the term in its exact sense, but in an illustrative way; in other words, it is a figure of speech. While upon the use of terms it would be as well here as elsewhere, to speak of the style of our author. Nothing in the way of medical writing can be more clear or simple. Most medical writers, unless they are stricken by Hugo or Carlyle, cannot be said to have any style; but concerning our author, if we were to apply to it the standard of old Hugh Blair, simplicity is the only term to convey an idea of the directness of expression, the freedom from ornament, and the painstaking effort to avoid confusion of expression. We fail to recall an instance in the book in which he has tried to clear up a doubtful meaning by turning the idea into another expression, which is a very common fault in text-books. Another feature that will strike the reader is the careful way in which excessive technicalities have been avoided. Our author has a correct idea of a technical word. Its proper use is not to convey a meaning but to give a definite form to an expression. Its use is to limit and so direct the sense that but one con-

struction, and that sharply defined within the limits of a single word, can be placed upon the sentence. As an instance, but not specially to illustrate the last comment above, take the following:

"The physician, whose duty is not only to heal the sick, but also to prevent disease and to improve the race, and hence one (who) must be a teacher of men and women, should teach sound doctrine in regard to the injurious results of precocious marriage. Mothers especially ought to be taught, though some have learned the lesson by their own sad experience, that puberty and nubility are not equivalent terms, but stand for periods of life usually separated by some years; the one indicates capability, the other fitness for reproduction."

It would have been a blessing, not in disguise, if the text-books written according to law to teach physiology in the common schools of New York, could have been expressed in such direct and simple English. One will notice the omission of pronouns, which is almost a mannerism of the author, which seems to come from his desire to construct a sentence without a superfluous word. On the following page, what can be more simple, exact, and graphic than the following description of the *corpus luteum?*

"The ovisac—its size lessened by the escape of the ovule and its surrounding granular matter, and of serous fluid, and the rent through which these passed closing—undergoes certain changes, which result in its obliteration, the most notable of these being the formation of the *corpus luteum*, or yellow body."

Would the young reader of that ever forget the cause and nature of this little spot? Neither our author, nor the reader must put a wrong meaning upon what our sum total of his style amounts to; it is complimentary, not invidious. It is this, by way of comparison; Lusk's treatise is one for the mature practitioner; Parvin's for the student or undergraduate. Not that one is more elementary than the other, but one is better fitted by happy simplicity of expression to convey an idea,—to break the ground, as it were, in the process of education. The result is that we know of no book that comprises a greater mass of facts within seven hundred pages than the one before us.

Upon menstruation, concerning the nature of which there are some well-grounded uncertainties, if such an expression can be allowed, our author permits no liberties. If he has any pet theory of his own, he evidently regards an educational treatise as no place for its exposition. In one sense he is right, but he must not forget that he is a guide as well as an educator, and that even a word of doubt or dissent is a useful stepping-stone to the truth.

Part second opens with the subject of pregnancy, of which the first chapter is given to conception, early development of the impregnated ovule, formation of deciduous membranes, and the fœtal appendages, and gives us a *résumé* of the latest theories.

The second chapter is devoted to the anatomy and physiology of the embryo. Very properly the author insists upon the distinction between fœtus and embryo which is so frequently confounded. Dr. Parvin adheres to Pajot's law concerning fœtal presentation. He says:

"Studying Pajot's law as it relates to the presentation alone, we find in the painless contractions of the uterus in pregnancy, in the varying abdominal pressure, and in the changes of position of the mother, which have more or less action upon the fœtus, the conditions of movement and rest; the fœtus

presents more of a rounded than an angular surface, and after the secretions of the sebaceous glands begin, this surface is smooth, slippery, and thus the amniotic assisting, the accommodation of the contents to the container is effected. This accommodation fails in those months of pregnancy when the uterus is very much larger than the fœtus. Thus Veits's statistics show that in 247 deliveries between the first of the fifth and sixth months, the head presented in 140, the pelvis in 95, and the trunk in 12. In the fœtus be dead and macerated, one of the conditions of the law fails, the content is no longer a solid body, and statistics show that in very nearly one-half of the cases when delivery takes place before six months the pelvis presents."

Many corroborative facts can be brought to bear upon the quite general utility of Pajot's law. Presentation of the pelvis is common in the hydrocephalic fœtus and evidently in obedience to the law of accommodation. In twin pregnancies there is a defect in this, with corresponding variations in errors of position. In hydramnios the law of accommodation is violated, so that breech and lateral presentations are common.

The author refers to the discussion in the New York Obstetrical Society of fœtal narcotism secondary to that of the mother. The matter must now be regarded as beyond dispute. Porak's experiments are absolutely conclusive. In one instance in which one grain of quinine was given to the parturient woman, the urine of the child born an hour and a half afterward showed the presence of the drug. Ruige made a similar observation. If the child in utero can suffer from intermittent fever the remedy is at hand.

The third chapter is devoted to changes in the maternal organism and to multiple pregnancy. Concerning the latter, our author adheres to the possibility of super-fecundation in the human female, adducing the familiar illustration of the white woman with twins, one white, the other a mulatto; or its converse, the black woman with a white and a mulatto child. It appears to us much more reasonable to regard them as instances of atavism, which is so very common in cases of mixed blood. At least in all phenomena of this nature the contrary of mixed races must be proved before we can offer superfecundation as an explanation. The latter aberration of fecundation is no more marvellous than that of superfœtation.

The fourth chapter upon the signs and diagnosis of pregnancy is very compact, and well written with no long exposition of the various signs, and is an excellent chapter for the student. The author's MS. was so far out of his hand at this point that he evidently could not include Hegar's sign of pregnancy, one of the very last of any value.

In the fifth chapter the author enters largely into the medico-legal aspects of the duration of pregnancy, the proof of previous pregnancies, and missed labor. At the conclusion of the section he gives a summary of the legal bearings of the duration of pregnancy by James I. Baker, Esq., of Indianapolis, which is the best exposition of the subject to be found in any text-book up to the present time, not excluding even treatises on medical jurisprudence, as it is a statement of decisions in the various State courts. Mr. Baker's brief upon the subject will evidently find a permanently useful field in the literature of this vexed question.

The management of pregnancy, the pathology of the condition, and eclampsia, are the subjects of Chapters VI., VII., VIII., and IX. Relating to the latter, the author alludes to the quite recent studies of

Doléris and Butte. They have found toxic ptomaines in the blood of eclamptics, which may cause the disease. If this view of the origin of the convulsions is confirmed by future investigations, we may put to one side the exclusive idea of renal origin. It is to be regretted that our author is so non-committal upon the treatment of eclampsia. In this grave accident the student needs an energetic guide. It is not so much a single question as to what is safe and that only, but what can be done that is not more dangerous than the disease itself? For instance, our author's most hearty approval of bloodletting is, that "the abstraction of blood gains time for the use of other therapeutic means, and prevents the consequences of congestion; the abstraction of ten to fifteen ounces of blood can only, in exceptional cases, be immediately or remotely injurious." Our friend, Dr. Clark, of Oswego, in his energetic use of morphia receives no word of favorable comment, although it is a practice that is gaining ground, and giving excellent results. The author leans to the free use of chloral, a drug that is certainly as potentially dangerous as morphia.

In Chapters X. and XI. diseases of the sexual organs and of the ovum are described. The only point necessary to call to the attention of the reader is the author's method of dealing with retained placenta after abortion at the third month. He is conservative and cautions against too active interference, quoting approvingly Churchill's conclusion, that they may be safely left to nature. There is surely no danger in proper removal of placental fragments, and the sum of opinion in this age of clean surgery, not to say midwifery, is in favor of removing all sources of septic infection. Surely, of all organs of the body, and of all material that may become incarcerated within it, no one is so prone to absorb, and nothing is so certain to decompose, as a uterus with retained fragments. That we do remove them days after the proper time for expulsion, filthy beyond description, and the woman show no evidence of blood-poisoning, is no argument to leave these cases to nature. Cases have came to the writer's knowledge in which the retained mature placenta was treated in the same Fabian method. Now, as a matter of fact, women do not often die from blood-poisoning due to decomposing placental fragments after spontaneous absorption, and it is upon this tolerance that the treatment by non-interference is based; but they do in some instances die, and there is a special liability to this result in instances of forced abortion, so that it is doubtful policy on the part of an educator to be conservative in his teaching upon this subject. If placental tissue, either in fragments or entire, is left longer than ten or twelve hours it is sure to be decomposed, the result of bacterial invasion; and the line of non-interference ought to be drawn about them as a matter of time Dr. Parvin may be right as a teacher to deprecate the use of the curette and other instrumental interference when the case presents no evidence of danger. The method he advises, that of the finger, is a safe and efficient one, but in case the cervical canal is closed, so that the finger cannot be introduced into the uterine cavity, as it very frequently is after twenty-four hours, it is not necessary to resort to gradual dilatation, as the author advises, with tents, but rapid dilatation is safer and better, and may be almost painless with a proper instrument and gentleness in manipulation.

Chapter XII. is devoted to the study of ectopic development of the ovum and placenta. A concise but excellent summary of the symptoms

of the former condition is given. The treatment by the faradic current is assigned an important place in the treatment. It is to be regretted that more exact rules for the application of the current to arrest fœtal life are not given. Garrigue's directions, that a moderate current for ten minutes at a time be employed, are of very doubtful utility. The writer has just been through an experience of this kind, and the method of Garrigues as quoted by our author would have been useless. It needs no argument to assert that the faradic electricity is used to destroy life. The fact that this life is of low grade does not imply that it will succumb to a mild form of the agent, passed for a short time. Fœtal life, to illustrate, is of as active a nature as that of vegetable life, and it is known by experiment that in the majority of instances a powerful current is needed to cause fatal molecular changes in the latter. Another fact, which every one who has used faradic electricity about the female pelvis must have noticed, is the great tolerance to the current in these parts. In one instance under the observation of the writer, the full strength of a large induction coil, with a current from two zinc-carbon cells, was used with but little expression of pain from the patient. It was impossible for the operator to hold the electrodes in his hands. A secondary current of this strength was passed through the fœtal cyst for an hour. Several séances of this character were had before it could be said that fœtal life was destroyed.

A word as to the evidence that the current has done its work. This ought to be looked for in the cyst rather than to abatement of the rational signs of pregnancy or to retrograde changes in the breasts. The most important are lessened tension in the cyst, which is observed long before the most delicate touch can assure the operator that there is actual diminution in size. The situation and character of the cyst are such that no manner of touch can measure it, it simply leads the observer to exert a scientific imagination that the cyst is diminishing. Next, the attacks of pain ceases. This will be noticed to coincide with the lessened tension of the cyst wall, and is probably due to the relief of pressure upon tissues but little tolerant of tension, and with but scant time to acquire adjustment to the morbid change. It is to be regretted that there is no accurate method of measuring the strength of the secondary current of an induction coil; if there were, it would be a very simple matter to designate the electro-molecular force necessary to destroy fœtal life in ectopic pregnancy; but in the absence of such a guide the writer would urge a strong current and a long séance.

At Part III. the author begins the study of labor. Eight concise, well-considered chapters dispose of the whole subject, which is given further value by a profusion of well-executed wood-cuts. Our author presents nothing new in the division of his subject. Abdominal palpation is well described and illustrated as it is now in all the recent handbooks. We have great faith in instruments of precision and of their influence upon the future of medical science; but it is quite an innovation on the general conservative tone of the book to have our author give the very ingenious instrument of Dr. Deaman, called a parturiometer, a very prominent place and give a few lines of comment rather unfortunately expressed. He says:

"The parturiometer indicates when it is proper to break the membranes, when the cervix is fully dilated; when the application of instruments becomes necessary."

There must certainly be something in Dr. Deaman's instrument that will cause such a statement from our author. We had supposed that in all the above indications the "when" was more or less of an intellectual process, and while instruments of this character are useful they will rather serve the purpose of exact study of phenomena than take a practical place at the bedside. Dr. Deaman contributes a page of description of his instrument which is very interesting.

The author enters fully into the subject of anæsthesia. In this period of multiplicity of agents of this character chloroform is given the chief place. It is evidently Dr. Parvin's practice to employ it, although the reader gains this idea by inference rather than directly. Chloral in the first stage of labor is mentioned, and probably serves as useful a purpose as general anæsthesia in the second. It is surprising how slowly anæsthesia in obstetrics has gained its place, and it is far from being in general use to-day. The writer must confess to having had a great reluctance in using it early in labor, and confined its use to the expulsive stage; but just before withdrawing from obstetric practice it was resorted to in every case, affording deep regret that for fifteen years he had given it but little use. It will certainly become generally employed when such a conscientious teacher as Dr. Parvin advises it.

A great variety of statements from various authors is given concerning the care of the perineum, and the student must be left in considerable doubt as to the better way; a careful reading leads to the opinion that it is the author's practice to support this part during the expulsion of the head. Chloroform is a better protection than the methods of support given in the text, as an anæsthetic prevents the energetic voluntary efforts on the part of the mother.

Immediate ligation of the cord is advised; or, at least, what the advocate of late ligation would call immediate. He says, "when the child breathes freely, and the pulsation lessens in force, one need not wait. In regard to waiting until all pulsation has ceased, one might, in some cases, wait until all patience as well as pulsation has ceased." None but the ardent advocates of late ligation can object to this. It will afford comfort to mothers and old nurses to know that the "belly band" is advised in dressing the child. It cannot possibly do any harm to apply a bandage properly to the abdomen of a newly born child, and yet it is a recent "fad" to leave it off. The binder to the mother also finds a consideration at our author's hand, and young practitioners had better follow the advice. It is a proper and comfortable article of dress, and ought to be so considered.

The chapter upon anomalies is contributed by Dr. Henry Morris, and is well written and illustrated.

The puerperal state is considered in Part IV., and is the shortest division of the book. We will omit all review of this section, except that which relates to puerperal septicæmia. Whatever may be the debt of surgery to antiseptics that of obstetrics is equally great, and a teacher of the latter must now occupy no doubtful position concerning the sources of puerperal sepsis. We can find no fault with our author in this. He speaks judicially, but positively:

"Independently of all culture experiments and inoculations, and microscopic examinations of the uterine and vaginal discharges of sick women in childbed, and of fluids or solids of women dying of puerperal septicæmia, there are some reasons which make it very probable that the infectious agent is a

living, a *contagium animatum*, rather than any chemical substance, whether sepsis or ptomaine. These are, the very minute quantity which infects, the rapidity of its action, and, finally, the protective power of germicidal solutions. It is only upon the hypothesis of a living poison with the great rapidity of reproduction which low forms of life have, that we can readily explain the fact of dangerous illness being so soon developed. And again, if we cure by using injections of corrosive sublimate, or of carbolic acid in solution, it seems more rational to conclude that the agent has destroyed living rather than rendered dead matter harmless. Moreover, the demonstrated dependence of many other diseases upon germs makes it probable that this also has a similar cause. . . . .

"The microbes which are most constantly found in puerperal fever are chain-like micrococci, and in many cases of the disease where these were not discovered it is possible they were still present, but methods of examination failed. Similar micrococci have been found in erysipelas, scarlatina, and in diphtheria, but similarity does not prove identity, and it may be that careful culture experiments will show that which the microscope has failed to do, an essential difference in these cocci. We must remember that microbiology is still in its infancy, and the relation of microörganisms to disease only begining to be demonstrated, and therefore we are willing to admit that the chain of evidence is not yet complete which connects puerperal fever with the action of microörganisms. Conceding this origin of the disease, are there different microbes for the different varieties of the disease? Or do differences arise from the quantity introduced, and the receptivity of the subject, and the time of introduction? A plant does not thrive equally well upon different soils, nor seeds germinate with equal rapidity in all seasons, and why not admit equal results in microbicum maladies? Scarlet fever in different epidemics and in different subjects, presents grades of intensity and degrees of danger widely separate, yet the poison is one and the disease is one. The origin of an epidemic of puerperal fever may be in a case of retained placenta where means have been employed to remove the placenta, these means failing to make the delivery complete; in a day or two the lochia become offensive, the woman has a chill followed by high temperature and increase in the frequency of the pulse. Other women are infected from this patient with different forms of puerperal fever, scarcely two presenting the same symptoms. Here then is a common cause, but various results; one fountain, but many streams.

"But what *rôle* do retained clots, or as in the instance just alluded to, do fragments of placenta play in the genesis of the disease? Are they innocent, so that it is a matter of indifference whether they remain in the puerperal uterus? No, for while they do not create the disease they furnish the nidus in which septic germs enter, a favorable soil for their development and multiplication.

"*Summary.*—From what is known of so-called puerperal fever it should not be regarded as a specific disease, and strictly speaking there is no puerperal fever, that which is so denominated being a febrile affection caused by the entrance into the system of a poison from without, the nature of which we do not know, the entrance taking place through a wound of the uterus, or of some part of the vulvo-vaginal canal."

No honest bacteriologist can take exception to this well-expressed summary of Dr. Parvin, or to any portion of the above. It is one of the best expositions upon the subject in any text-book, and will produce a healthful mental impression upon students and practitioners. To those who are fond of a well-turned sentence we hold the following up as one of the cleverest in medical literature. We have already quoted it, but it will bear repetition. "It seems more rational to conclude that the agent has destroyed the living rather than rendered dead matter harmless." It is the gospel of disinfection, and the whole creed of the bac-

teriologists; but it provokes the reviewer into saying that it is a great pity that a man who can express a conviction so fairly and so happily has not thrown authorities and their conflicting dogmas to the winds and become Parvin himself from cover to cover, as he was so well able to do. When will some American treat the subject of obstetrics as Emmet has that of gynecology, and not like Lusk, who has written the best German work on obstetrics in the English language, or like one not yet upon the shelves of our library, which is the best digest upon the subject up to date.

We are not yet through with our author upon the subject of antiseptic midwifery. Now with the author's clearly expressed views upon the subject of puerperal infection before us, we are prepared to say that prevention is of much greater utility than treatment. In fact, what physician has not the misfortune of knowing how useless are some, if not all, of the best laid plans of medication, and even disinfection, in the presence of this disease? We have seen how fully in line with the most advanced writers Dr. Parvin is upon the subject of antiseptic midwifery; but as in this practical part of his treatise we have to consider methods not opinions, let us inquire how perfect are his methods for the protection of the lying-in woman. Turning back to his chapter upon the conduct of labor the author says:

"Thorough disinfection of the room which the patient is to occupy should be made, if it has been previously occupied by one suffering with scarlet fever, with erysipelas or diphtheria, or with any disease attended with suppuration, as uterine cancer in its advanced stages; it would be better, indeed, for her lying-in to be in another house, or other room. The room, too, should be free from the effluvia of decaying animal matter. If there be any sewer communication in it, as, for example, from the permanent wash-stand, that communication should be for the time, at least, cut off. The obstetrician must know that the nurse has not recently been in attendance upon any of the forms of disease that have been mentioned and especially upon a case of puerperal septicæmia."

This is all very well and no possible exception can be taken to it so far as it goes; but the best comment we can make upon it is to quote from a recent paper by Prof. William D. Richardson, of Harvard, published in the *Boston Medical and Surgical Journal* for January, 1887. He is writing upon the use of antiseptics in obstetrics, as illustrated in the Boston Lying-in Hospital:

"The various changes which have been in the attempts to rid the hospital of septicæmia, have been the results of careful study and observation on the part of the visiting physicians, and after many anxious consultations on the subject. As one septic case occurred after another, every effort was made to avoid any possibility of contagion from a patient presenting symptoms of septic infection to another. Isolation of suspected cases; the employment of extra and special nurses, the assignment of different house-physicians to the infected, and to those whose convalescence seemed normal; the use of every possible precaution to insure cleanliness, the providing of individual bed-pans, syringes, etc., constant attention to ventilation and improvement in the drainage, were among the methods adopted. Many of these changes seemed to promise improvement, which, however, was always found to be temporary. From the very outset the staff were a unit in the belief, even then not generally accepted, that the views of Semmelweiss were correct, and our object was to prevent the entrance of septic material from without, and the prevention of the absorption of septic material originating within the uterus and generative tract. With this latter end in view, we soon began the use of vaginal injections,

hoping to keep disinfected those parts especially exposed to the lochial discharge, which seemed to us one great source of danger within the patient herself. These were subsequently not infrequently combined with intra-uterine injections, hoping thereby also to render innocuous the clots and placental débris within the uterine cavity. All these attempts proved futile, although occasionally it did seem as though some new method of procedure which we adopted was at last to offer the long sought for relief. The respite was, however, only temporary, and still the mischief went on.

"In the middle of the winter of 1883 and 1884, corrosive sublimate was first tried, not only as a vaginal douche but also for the disinfecting of the hands of the attendants. A very decided improvement followed this method of procedure, and again the outlook was more cheering. Still septicæmia remained with us, but in a more modified form and the death-rate fell decidedly. Then came the announcement of Robert Koch's investigations of bacteria, and . . . . we determined to change our whole system."

We will now return to our author and continue the quotation from the next paragraph to the last on the conduct of labor.

"It is well for the parturient to take a warm bath at the beginning of labor, and afterward to have the external genital organs washed with a two or three per cent. solution of carbolic acid; when the labor is protracted, a similar solution may be used as a vaginal injection once or oftener. A three to five per cent. solution may be used by the physician, and by the nurse for washing their hands. The former not only should use an antiseptic solution in which he washes his hands before each examination, but also an antiseptic ointment applied to the fingers before introduction into the vagina; this may be carbolized cosmoline, or iodoform and cosmoline, or an ointment may be made by incorporating with an ounce of cosmoline, one-tenth part of thymol."

As the latest expression upon this vastly important subject of antiseptics in labor, and to contrast the very material difference in methods, we will introduce one more extract from Prof. Richardson. It relates solely to the conduct of labor.

"In every case the genital and surrounding parts are washed with a solution of bichloride of mercury ($\frac{1}{3000}$). A basin containing the same solution and a nail-brush is placed on a stand by the side of the bed. The physician and nurse in attendance disinfect their hands every time they have occasion to examine the patient or touch the neighborhood of the vulva. The examining finger is smeared with an ointment made of one part of the oil of eucalyptus and seven parts of vaseline. A vaginal injection of the corrosive sublimate solution is given at the beginning of labor, and this is repeated when circumstances permit at the end of the first stage. As the head distends the perineum and is expelled the parts are kept clean by the use of charpie dipped in the mercurial solution. After the birth of the child, no undue haste is made to bring about the expulsion of the placenta. This is effected, if possible, by Credé's method of expression, great care being taken not to introduce the hand within the vulva, if such a procedure can be avoided. The original injection is repeated, and the antiseptic pad is applied."

It is by such means as the above that the dark picture of septic infection has been changed and lighted up. It proves that infection comes from without; that its introduction can be prevented, and that, as a prophylaxis, it is as complete as vaccination is to smallpox. Contrasting the two extracts, it shows that our author is right, and that he believes in the best teachings of the bacteriologists; but his methods are doubtful. A two or three per cent. solution of carbolic acid has been demonstrated to have no more value as a germicide than clean water.

But we do not bring this up as a critical matter. Our author is treating antiseptic midwifery, and anything that would lead the student or practitioner into the false security of half measures is a fault equally as great as not to teach it at all. This is a practical matter. Opinion has nothing to do with it. Demonstration has made it clear as the sun at noon-day, and it is therefore a question of methods, and those methods by which the most perfect results have been attained are those which ought to be taught. The opinion that one may have, that one procedure is as good as another, has nothing to do with it if the two methods have not been put to equal tests. There is a certain moral responsibility in teaching that reaches such a high level that one may try in vain to attain it by the force of opinion. He reaches this altitude by facts, surrounds himself with them as with an atmosphere, and lifts up to his own level all who follow after.

The author resumes the subject of antiseptics in describing the treatment of puerperal septicæmia in which further prophylactic measures are followed in the convalescence, while his remedial measures are of an active antiseptic nature, and in all of which he is in accord with the best teachings. In all that has been said of a critical character above we wish in no way to detract from the real value of this important section of his book. In fact, it may be said to be in advance of any recent text-book; but since the latest American text-book very material advances have been made upon this subject, and the practitioner to be properly instructed should have a practical knowledge of the best methods of maternities in order to judge how perfect he must make his antiseptic details at the bedside.

The fifth and concluding part is devoted to obstetric operations, beginning with the induction of abortion, premature labor, and turning. The latter is presented in accordance with the precepts of Dr. Samuel Sloan. The instructions as to turning are very simple and practical, and will serve to do away with the fears of the young practitioner lest he gets hold of the wrong foot.

The forceps are studied in the second chapter. There is a well written history of the instrument, illustrated with cuts of the older and later forms, followed by the theory of the forceps and the mechanical principles involved in their application as levers, tractors, and rotators. Chapter VIII. disposes of the indications for the application of the forceps and the rules governing their use in general, followed by special instructions in different presentations and positions. This chapter is one of the most practical in the book, and too much praise cannot be awarded the author for the simple and clear manner in which this usually difficult subject is disposed of. The application of the forceps is so simply and clearly described that the least learned practitioner can understand it. It is not always so, as a very recent instance will show, in which a New York reviewer got so tangled up with his author that he could not understand whether he meant the right or left thigh of the mother, or his own right or left hand. We read and reviewed the same description and thought it a very good one; but as the reviewer was a very learned man, we always thought it was stupid on our part not to confess to an equal degree of confusion.

Chapters IV. and V. conclude the book, and are devoted to the subjects of Embryotomy and the Cæsarean operation and its substitutes. The latter will alone detain us. At the opening of the chapter we are

startled by a table compiled by Dr. Harris showing the strange fatality attending this operation in the United States; no mothers saved here, while in Germany, 84 per cent. of the mothers were saved (25 operations, 4 deaths), in the past year.

"Leopold operated for the tenth time in June, 1886. This gives him the loss of one woman in ten, or from his hospital, a saving of ten women and three children from eleven operations. Now if such success could be obtained by practitioners generally, craniotomy upon the living fœtus would soon become unknown."

It is not a little singular that after various improvements in the operation, we have as the best method of operating, returned to the so-called improved Cæsarean operation, which is the old way of operating, nothing more. It is simply done more carefully, with more hope in it. In one operation, we remember hearing one of the physicians present urge the operator to take less time to clean the abdominal cavity as the woman would die any way; and that seems to be the spirit in which the operation is often made. Now, the improved operation, as described by our author, who follows Potacki, is simply the old operation made with more care, as to suturing the uterine wound and antiseptic precautions.

Porro operation and the Porro-Müller modification are next considered, and contrasted with the Cæsarean. Up to 1885 it does not offer as good results to mother and child as the latter.

"Up to March, 1885, fifty per cent. of the mothers recovered after the Müller modification, and forty-four per cent. after the unmodified Porro." "There are," the author continues, notwithstanding this greater success of the Cæsarean operation, "instances in which the Porro or the Porro-Müller would seem to promise the greatest success. When, through unwarranted delay, or by reason of unwarranted attempts at delivery the uterine tissues have been seriously injured; or when the child is putrid, or when the patient is greatly exhausted with incipient or established septicæmia, the amputation of the uterus and its appendages by the Müller method would seem preferable to the Cæsarean section; again, when there is extensive fibroid or fibro-cystic degeneration of the uterine body, an amputation at the neck would be indicated. Whenever there is especial reason to fear septicæmia, the Müller modification should be preferred to the Cæsarean section without amputation."

It is difficult to understand why in case of septicæmia Müller's method should offer better chances when we consider that the chief cause of death after Porro was from blood poisoning, while exhaustion has been the most frequent cause of death after Cæsarean section.

Gastro-elytrotomy is given a short notice with a valuable historical paragraph. Dr. Parvin says:

"Even if the general success of the operation could be made equal to that which Skene has had, saving three mothers and three children in four operations, this by no means equals that which may be hoped for from the improved Cæsarean operation. Moreover, gastro-elytrotomy is impossible in many cases in which the other method of delivery can be employed. Its performance is liable to cause injury of the bladder, and it is followed by prolonged suppuration."

A brief notice of the Cæsarean section in post-mortem delivery closes the volume.

We have reviewed the book of one whom we know; we know his thorough conversance with his subject; we know the thoughtfulness of

the man, and we know if he had stripped himself of his allegiance to authority and written from his own ripe experience, told in the terse and simple manner of the book before us, he would have produced a better book; not better in the sense of a teacher, but better in the sense of individuality, that pervading spirit within the covers of a book that makes it live for itself and the glory of its author. It is one thing to be a teacher; it is another thing to form opinion for those who come after us. One must elect which he will be. It is a ripe harvest that Dr. Parvin offers to his readers. We are satisfied with his labors, and he has done well. He has elected to be a teacher and as such he has followed in the steps of those who have gone before. He has crystallized the thought that has ripened; he has been a gleaner but has planted no seed for the harvest of the future. But the gleaner has his use as well as the sower of seed and without him there would be an end to all progress. It has been said that one who invents a new flavor is greater than he who captures a city, but how much greater is one who sets all after-coming men thinking.

There is no book that can be more safely recommended to the student or that can be turned to in moments of doubt with greater assurance of aid, as it is a liberal digest of safe counsel that has been patiently gathered.

E. V. DE W.

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DISEASES OF THE JOINTS. By HOWARD MARSH, F.R.C.S., Senior Assistant Surgeon to, and Lecturer on Anatomy at St. Bartholomew's Hospital, Senior Surgeon to the Hospital for Sick Children, and to the Alexandra Hospital for Hip Disease. 12mo. pp. 460. Philadelphia: Lea Brothers & Co., 1886.

AFTER briefly adverting to the history of joint surgery and demonstrating how it has fully kept pace with the rest of the art, Mr. Marsh shows that this advance has been chiefly due to the gradually increasing recognition of the efficiency of prolonged rest in staying the progress of even scrofulous joint disease, and to the application of the principles of aseptic surgery, which latterly "has produced results which can scarcely be exaggerated in the management of suppuration in joint disease. It is now well known that matter, whether connected with acute or chronic arthritis, may be safely evacuated, with the result that the severe suffering, the prolonged fever, the wide and destructive burrowing, and the formation of sinuses, which were the common rule only a few years ago, can be generally avoided. These results are more far reaching than at first sight they appear to be; for when disease can thus be checked at the outset, and when, should suppuration occur, the complications formerly so constantly met with in connection with large collections of matter can be averted, diseases of the joints become in their whole aspect much less formidable, they extend over much shorter periods, they lead to no material deformity, they cause comparatively little suffering, they inflict but little injury on the general health, while such mutilations as excision and amputation are falling more and more into disuse."

These sentences epitomize the author's theory and practice in the treatment of all forms of joint disease, with, of course, certain minor

details, which, when examined, prove only to be modifications—not contradictions—of these rules. Admirable as rest is, beyond all question as are the advantages of, nay necessities for aseptic surgery, yet our experience has taught us, that with every advantage on our side, there yet remain more cases rebellious to perfect rest from their outset than Mr. Marsh is willing to confess.

We shall quote further on some of his extreme views as to the possibilities of rest in all cases, if commenced as soon as joint symptoms appear, and persevered in for years; but in passing we must protest against the teaching—while fully believing in the paramount advantage of rest—that only the very rarest exceptions to the rule of cure will result, if Mr. Marsh's plan be pursued, since this is a most dangerous doctrine both for patient and surgeon: for the former, since he loses faith and unfairly blames his attendant; for the latter, because it lays him open to a prosecution for malpractice.

Mr. Marsh does not believe that all strumous affections are tuberculous because, apparently, of the absence of tubercle bacilli in some cases, ignoring the results obtained both experimentally and clinically by some of the French observers with these non-bacillous cases.

Again—and here most correctly—he points out that joint cases which occur in patients with strumous tendencies are often not spontaneous, but have been lighted up by a traumatism without which no trouble would have occurred, while a mere chronic joint trouble with destructive tendencies is no proof whatever of struma, but is in many cases due to the alleged traumatism from which it started, plus want of proper treatment by rest, etc. All this we cordially endorse. On the other hand, he also apparently believes that there are a certain number of patients whose affections are solely due to the deposit of tubercular products in their osseous or articular tissues.

Holding such views, excisions of joints and amputations of limbs for the prevention of a generalized tuberculosis are only mentioned to be declared unworthy of consideration. Unlike so many of our more pretentious works, this one has been written by a surgeon of ripe experience in special fields, so that we hesitate to differ from him, and yet, do not modern theory, practice, and experience all teach very much to the contrary? Of course, there are exceptions; but according to our view the exceptions are reversed—*i. e.*, what are Mr. Marsh's exceptions we are inclined to think rules, while his rules—with respect to struma, be it understood—we consider exceptions. Perhaps this is too broadly stated, but it approximates the truth.

Mr. Bowlby is credited with the pathological portion of the work, his descriptions having been adopted by Mr. Marsh. In the main, the brief descriptions given are good, but who is responsible for the following extraordinary pathological fact? "The bloodvessels dilate, *fresh capillaries are formed*, the blood-stream is at first accelerated, but soon stasis in many places ensues" (the italics are ours)! Nothing is more certain in pathology than that new bloodvessels do not form at the stage when the blood-current is accelerated, the bloodvessels next dilating, and stasis is only incipient. What the author probably means is, that first there is either contraction followed by dilatation, or primary dilatation of the vessels with accelerated flow, then stasis, then migration of cells, during which preformed capillaries dilate so as to admit so much red blood as to become distinctly visible, and then, perhaps, the formation of new blood-

vessels *does* take place, provided cell migration and proliferation advance to the point of forming false membranes or granulation tissue. Equally pertinent criticisms might be made of other pathological statements. We think that either Mr. Bowlby should have been solely responsible, or that Mr. Marsh should have expressed some positive opinion as to his own views, and not have cautiously alluded to all the views held, in the compass of a few lines, and then have left the reader to his conclusions, which must be vague indeed when drawn from such premises.

Speaking of acute synovitis, the advice is given to retain the limb in the position into which the disease has brought it by well-fitting splints for a few days, after which, the rest having removed the muscular rigidity, the limb will naturally subside into a good position. We are glad—while not objecting to the operation—to see that the author warns his readers that aspiration of a joint acutely inflamed is not "devoid of risk." Blisters are highly spoken of throughout the work, but no caution is given against their application over superficial joints. Thus, on either side of the patella between the skin and synovial membrane *very* little tissue exists, and counter-irritation is too often a misnomer, since epispastics, especially if allowed to remain too long, *directly* irritate the synovial membrane. Irritation of the vascular areas *above* and *below* a superficial joint is the better practice, while even the formation of an eschar may be beneficial over a deep-seated joint, as the hip: this is our practice, and general experience has demonstrated its value.

The general impression of the hopelessness of saving a movable joint or even life when acute suppurative arthritis of a large joint occurs is combated, and we are glad to see that the author has proved by results what we have ourselves demonstrated, that free incisions, drainage, and aseptic dressings will often save life and at times a useful joint.

The section on gout should be most carefully read by the American practitioner, who, in general, seems to be possessed by two erroneous impressions, viz., that gout affects only the smaller joints in a first attack; that nothing but port wine and high living can produce gout; and that, in consequence, the disease must be *very* rare here, ignoring the fact that malt liquors in large quantity in those who use but little exercise will develop the disease *de novo*, all the more so if there be hereditary taint. We frequently see the evil effects of this wilful blindness as to the prevalence of latent and at times frank gout in this country.

Again, in rheumatic fever, should suppuration occur, at once the practitioner thinks he has made a mistake and that the disease was pyæmia all along. This may be the true explanation, but when only one joint suppurates the original diagnosis is probably correct. Rheumatic joints are also too commonly considered so safe against displacement as to be unworthy of any special care, but Mr. Marsh avers that in the knee, wrist, and ankle, there is decided risk of displacement and deformity when the disease is persistent.

In an excellent chapter on so-called "Osteo-arthritis," the author shows by a series of brief but admirable pen-sketches, that the condition called by former authors rheumatic gout, chronic rheumatic arthritis, arthritis deformans, etc., and now termed osteo-arthritis, is not a unity but a number of differing diseases which merely present certain resemblances as the ultimate result of their morbid processes. Mr. Marsh uses the term osteo-arthritis as a convenient general heading for a group of diseases characterized by a generally chronic, steadily pro-

gressing, painful stiffening, enlargement and distortion of the joints, with destruction of the cartilages, ligaments, and surrounding tendons, osteophytic formations at the articular edges and sometimes in the remains of neighboring tendons. Pathologically consisting of no less than seven different groups, in general terms it is either purely a degenerative change, "or a degenerative process to which a variable but limited degree of inflammatory action is superadded." Although generally chronic, there is an acute form which closely simulates acute rheumatism, although without the profuse sweatings and tendency to acute endo- and pericarditis, but which may in a few weeks seriously damage many joints. In addition, there is another rare form which attacks young subjects—even so young as two and a half years. As there are in reality so many different diseases grouped under this one head, so is the treatment various; but for details we must refer the reader to the original. Hydrarthrosis is looked upon as probably the result of ill-marked osteo-arthritis, and the important fact is emphasized that when bursal enlargement occurs in connection with hydrarthrosis, the bursal sacs commonly open into the joint cavity.

From an extended but excellent chapter on "Charcot's Disease," we shall quote but one sentence: "It is certainly necessary, without falling into the absurdity of finding Charcot's disease in every case of osteo-arthritis, to be on the watch in obscure examples of disease attacking a single joint, especially it the articulation is free from pain, although the seat of advancing deformity, for the occurrence of ataxic symptoms."

The author's views concerning scrofulous diseases have been already referred to and it now only remains to quote a few sentences. "The estimate of their gravity is often formed partly from tradition, partly from what is seen in the wards and out-patient rooms of hospitals, where every day children are admitted whose joints have undergone complete disorganization." . . . "Such cases as these, however, convey a highly exaggerated impression of the intractable nature of these affections. It must be remembered that a disease of inflammatory character is very much what it is allowed to become." . . . "In their incipient period these affections are, to a degree which some appear unable to credit, amenable to the influence of appropriate treatment." . . . "The presence of amyloid disease in its early stage is no bar to operative interference, even although the urine may contain a considerable amount of albumen." Rest, prolonged for years if necessary and—until the very last—in the horizontal posture, is the treatment advocated, there being no risk, so maintains Mr. Marsh, that the joint will be rendered stiff by the rest alone. As to this latter point we are in perfect accord with the author.

"Epiphysitis and Acute Arthritis of Infants" form the subjects for an interesting and instructive chapter. "Quiet Disease" is next treated of, wherein it is stated that instances "are not rarely seen in children between four and twelve, in whom the shoulder-joint is found to have become stiff, though none of the other signs of disease have been observed." So with other joints. These cases are apt to be confounded, in their early stages, with cases of muscular rigidity following injury, all the more so because at first under an anæsthetic the joint moves freely and smoothly. "In the hip all the usual symptoms, except stiffness, may be so entirely absent that for many months no suspicion of the real state of the case is excited."

Complete rest for months is the only treatment, and in many cases the

joints will ultimately recover with good motion. In some cases, however, rapid ankylosis sets in, and these are the cases which have given rise to the idea that joints kept at rest become ankylosed, but this is the marked exception even in "Quiet Disease." Syphilitic diseases of joints, the joints in hæmophilia, diseases of bursæ, and the formation of cysts in connection with the joints, are all sufficiently fully treated of. Loose bodies in joints are elaborately discussed and operative interference with antiseptic precautions is advised, with the pertinent remark "that the statistics of fifty years ago have no bearing whatever on the practice of the present day."

Internal derangement of the knee and other joints is shown to be far more frequent than is commonly supposed. When dealing with a case where the injury which has produced the displacement is severe enough to cause also acute synovitis, or where the displacement has produced the latter complication, caution is requisite lest the luxation of the cartilage be overlooked, and the stiffness remaining after the inflammation has subsided be attributed to this cause. Where the slipping of the cartilage becomes inveterate two varieties of clamps are figured which are notably efficient, but do not interfere with walking. Reference is made to Prof. Kocher's description of what he terms meniscitis fungosa, or fungous enlargement of the internal meniscus of the knee-joint; removal by operation is all that is available in such cases. Much interesting matter is contained in the chapters on "Bone-setting," and "Congenital Dislocation of the Hip," but no comments will be made except the statement that the author seems to show conclusively that slight varieties of congenital hip luxation often exist which are either overlooked or mistaken for some other trouble.

An able chapter is devoted to the "Prejudicial Effects of Intra-articular Pressure and on the Danger of Producing it by Surgical Appliances." It will perhaps be difficult for the reviewer to make plain that which the author demonstrates so well by means of a few diagrams, but the subject is of too much importance to be passed over. The author conclusively demonstrates, that while extension by weight and pulley in a perfectly extended hip or knee will *remove* intra-articular pressure, yet if the leg be flexed upon the thigh or the thigh upon the pelvis, by the spasmodically contracted hamstring muscles in the former and the iliopsoas muscle in the latter, these structures at once become fulcra and the articular surfaces are brought into abnormally close contact by leverage of the second order. For this reason extension should, at first, be always made in the *direction of deformity*, and gradually, in the course of a few weeks, the line of traction may be changed as the irritated muscles relax, until the knee or hip is perfectly extended. The practitioner would do well to consult this chapter, which, to our mind, seems the one most pregnant with good results.

The chapters on nervous mimicry and tumors of joints, while up to the average, demand no special notice.

In fibrous ankylosis after strumous disease emphatic warning is given against the attempt to restore movement, a most fatal error, which we think must have now fallen into almost total disuse, since it has been almost universally discountenanced of late years. Two omissions we regret to see in the advice concerning breaking of fibrous ankylosis, viz., the advisability of perfect quiet for a few days, the immediate application of an elastic bandage, or elastic pressure by compressed sponge, and

the use of dry cold when the operation is a severe one, for in this way much can be done with perfect safety and much utility; and that dislocation of the head of the tibia backward may be partly or entirely prevented, when attempting to straighten a contracted knee by subcutaneous division with a tenotome of the anterior, or even both crucial ligaments, a practice—following the lead of a well-known surgeon—which we have long advocated and seen prove successful: the patella may likewise be dissected off subcutaneously when adherent. Of course, strict antiseptic precautions must be exercised.

Mr. Marsh contends that we must entirely revise our ideas as to excision for strumous disease, that the statistics of even ten years back are in many instances obsolete, that excision is now comparatively not dangerous, that strumous disease both by conservative and operative treatment has alike only about ten per cent. of mortality, allowing the widest margin; that "excision under favorable conditions can be, and had better be, avoided;" that "recovery will, as a rule, except in very advanced disease, be secured by rest;" and, finally, he believes "that in the future excision will fall more and more into disuse, as the treatment by rest gradually wins its way." While by no means a pessimist, we can hardly feel justified in indulging in such roseate visions, when we reflect upon the perversity and unwillingness to submit to restraint for lengthened periods shown by the average patient or parent.

Excision of the shoulder is said to be, "on the whole, deservedly unpopular," an opinion from which we most positively dissent. In excising the elbow, to gain a flexible joint, the rule is given that the ends of the bones should present an interval between them of at least half an inch when put up in the splints. Excisions of the other joints are viewed very unfavorably, being really advised only for the removal of deformity in the case of the knee, or for deformity plus extensive suppuration in the hip. Diseases of the different articulations are elaborately, and we think well treated of in the remainder of the book, but from what has already been said little remains for us to call the attention of our readers to, since the details differ in no material respects from those of other standard works.

We wish that experience in our own practice or in that of our friends could induce us to agree with Mr. Marsh in his favorable views as to the mortality and after-condition of cases of strumous knee and hip disease. Thus, in the knee, recovery may "be confidently anticipated except in a few cases in which the disease proves to be more than commonly destructive." For the hip, he says: "In cases that are detected early and adequately treated perfect recovery, with complete restoration of movement, may often be obtained. In many others the only appreciable defect is a slight limp, due either to loss of free movement, to reflex atrophy of the muscles, or to slightly arrested growth of the limb. Even in instances in which disease has produced faulty position and suppuration, the treatment by rest continued for a year or for a still longer period, and combined with extension to correct distortion, and with the early evacuation of pus will often enable children to recover without deformity, with almost perfect movement in the joint, and with scarcely a limp." Surely this is a most exaggerated statement of the facts.

Although we have seen fit to differ from Mr. Marsh both on theoretical and practical grounds in some few instances, yet we regard the

book as excellent, and one the writing of which will redound to the credit of the author. This, like all the other clinical manuals issued by this firm, possesses one preëminent advantage, viz., that, however much the views of the authors may differ from those we, or others, hold, the opinions are enunciated by those who have been taught by extensive experience, and not by ambitious writers, who, desirous of the name author, are too often evidently first becoming acquainted with their subject when studying the literature relating to it. C. B. N.

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RECENT WORKS ON THE TREATMENT OF THE INSANE.

1. THE CURABILITY OF INSANITY: A SERIES OF STUDIES. By PLINY EARLE, A.M., M.D., Late Superintendent of the State Lunatic Hospital, at Northampton, Massachusetts, etc. 8vo. pp. 232. Philadelphia: J. B. Lippincott Company, 1887.

2. THE PRIVATE TREATMENT OF THE INSANE AS SINGLE PATIENTS. By EDWARD EAST, M.R.C S., L.S.A., Member of the Medico-Psychological Association. 12mo. pp. 68. London: J. & A. Churchill, 1886.

3. INSANITY AND ALLIED NEUROSES: PRACTICAL AND CLINICAL. By GEORGE H. SAVAGE, M.D., M.R.C.P., Physician and Superintendent of Bethlem Royal Hospital, etc. 12mo. pp. viii. 544, with 19 illustrations. Philadelphia: Henry C. Lea's Son & Co., 1884.

1. DR. EARLE, one of two survivors of thirteen physicians who founded the Association of Superintendents of American Institutions for the Insane, has presented in this volume a series of "studies" on the curability of insanity. Connected as he has been as a medical officer with one asylum, as a medical superintendent of two asylums and with the literature of insanity for a period of more than forty years, whatever he may state at the close of a long and honorable service is entitled to respectful consideration. The purpose of the author is to correct erroneous impressions that might be drawn from the earlier reports of American asylums of the curability of insanity, and to ascertain the results which more extended experience has since established. In this direction the author may be said to have done an excellent work, and to have presented a successful and exhaustive arraignment and impeachment of earlier reported asylum results.

The book comprises eight so-called "studies," which have been read before the New England Psychological Society, or have appeared in the annual reports of the Northampton (Mass.) Hospital. "They have thus been an important agent in stimulating the minds of philanthropists to seek—and in several notable instances to adopt—other methods for the custody and care of a large part of the insane than that of collecting them in expensive and unwieldy curative institutions."

In 1820, Dr. Burrows, of England, reported the proportion of recoveries of all cases treated by him, 81 in 100; of recent cases, 91 in 100. In 1826–27, Dr. Todd, of the Retreat, Hartford, reported that of twenty-eight recent cases twenty-five recovered, equal to eighty-nine per cent.

Dr. Woodward, of the Worcester, Massachusetts, Asylum, says in 1837, "per cent. of recent cases discharged recovered, of less duration than one year, eighty-nine, and in his report in 1841, ninety one per cent. recovered." Dr. Galt, of Virginia, reported in 1842 an equal result, and that the West might not be outdone, or charged with doing its scientific work on a contracted scale, Dr. Awl, of Ohio, in 1843, "unpretentiously reported" his achievements of one year, as follows: "per cent. of recoveries on all recent cases discharged, one hundred." Dr. Earle in a report of the Bloomingdale Asylum for 1844, states that "when the proper remedial measures are adopted in the early stages of the disorder, no less than eighty of every hundred are cured."

Since the "summit of the maximum wave of the highest possible high-water point was gained" in the record of cures, there has been a steady decline of the per cent. of reported recoveries. Dr. Earle devotes a chapter to the "ebbing tide" to explain in part the sources of error in the early hospital reports in this and other countries, and to present some conclusions as to the curability of insanity. It is shown:

"1. The reported recoveries from insanity are increased to an important extent by repeated recoveries from the periodic or recurrent form of the disease in the same person; and consequently,

"2. The recoveries of *persons* are much less numerous than the recoveries of *patients* or *cases;* and, consequently,

"3. From the number of reported recoveries of *cases* or *patients*, it is generally impossible to ascertain the number of *persons* who recovered.

"4. The large proportion of recoveries formerly reported was often based on the number of patients *discharged*, instead of the number *admitted*, and *generally*, upon the results in a number of cases too small to entitle the deduction therefrom of a general formula of scientific truth; and those proportions were evidently increased by that zeal and rivalry which frequently characterize the earlier periods of a great philanthropic enterprise."

To illustrate, the data from which Dr. Earle has drawn his deductions are furnished from an analysis of the operations of the Friends' Asylum, by Dr. Worthington, and reports of other asylums. One thousand and sixty-one recent *cases* were admitted into the Friends' Asylum during a period of fifty-nine years of which sixty-five per cent. recovered, but these *cases* were not *persons* and eighty-seven of the persons recovered two hundred and seventy-five times, or one hundred and eighty-seven times more than the number of persons. At the Hartford Retreat five persons furnished fifty-four recoveries; at the Bloomingdale Asylum five persons furnished eighty-five recoveries; at the Worcester Hospital two sex groups of five each one hundred and thirty-six recoveries; and in one other hospital one person furnished thirty-four recoveries. While these are probably extreme illustrations, it appears on examination that of 11,000 cases admitted into the Worcester Hospital, the number of persons was only 8204, and a similar result might probably be shown in the statistics of other hospitals.

Turning to a later period, the author, in the concluding chapter, proposes to show the results of treatment in a large number of foreign and domestic institutions, bringing our knowledge to a recent date, and presents what may be considered the hospital work accomplished at the present day. For this purpose he uses the statistics of forty-six English and Scotch asylums from 1872 to 1882 inclusive, published by T. P. Chapman, England, in the *Journal of Mental Science* for July, 1884. The

collection embraces 93,543 cases, of which 35,468, or 37.9 per cent. of the whole number of admissions, recovered.

Considered with reference to the duration of less than one year 69,983 cases are classified as follows:

| | | | |
|---|---|---|---|
| First attack, less than three months, | 38,283 | Recoveries, 18,654 | Per cent. 48.72 |
| " " three to twelve months, | 12,126 | " 3,421 | " 28.21 |
| Not first attack, less than twelve months, | 19,574 | " 10,494 | " 53.61 |
| Totals, | 69,983 | 32,569 | 43.51 |

The American result is ascertained by taking the recoveries reported at twenty hospitals at three periods of their existence, viz., the first five year period dating from the opening of the asylum; the second five year period begins with 1871; and the third period of five years begins with 1880.

| | | | |
|---|---|---|---|
| Aggregate admissions first period, | 14,516 | Recoveries, 6,689 | Per cent., 46.08 |
| " " second period, | 24,383 | " 8,354 | " 34.26 |
| " " third period, | 23,052 | " 6,896 | " 29.91 |
| Whole number, | 61,951 | " 21,939 | " 36.71 |

At fifty-eight American institutions the whole number of patients admitted in one year, 1884, was 14,372, of which 27.88 per cent. recovered.

Dr. Earle has done a good work in his successful effort to point out sources of error in the statistics of insanity which appear to have had their origin in the New England States, and with his early contemporaries. For more than twenty years, however, they have been recognized and avoided by the leading hospitals of the country. While the per cent. of reported recoveries has been steadily declining, the fact might have been properly ascribed to a limited knowledge of the nature of insanity that existed at an earlier day; to preference in admission given to recent cases and exclusion of chronic cases; to the increased number of hospitals at the present day, and the distribution of the limited number of recent cases among a larger number of asylums; the retention of chronic cases in the asylums to a greater extent than ever before, and not to a decline in the means or skill in the treatment of the insane. As a matter of fact, never in the history of the care of the insane were they treated in a more enlightened and humane manner, or with more knowledge and intelligence. We may go even further and express the conviction that recent cases of the present day are more successfully treated than at any previous period. A perusal of the book may tend to a pessimistic view of the whole subject, yet such an impression was hardly intended to be conveyed by the author. We must accept his purpose to furnish an argument sustained by statistics which he believes has already "caused a very important change in the statistical methods of Massachusetts, in this country, Great Britain, and in Europe."

2. Mr. East assumes that treatment in the patient's own home will be first attempted, "but, as a rule, will fail because of the many familiar ways and habits of the home, where the patient has been accustomed to command, and to do as he pleases," and concedes that if the patient is not so ill as to be confined to one room it is generally best to intrust him to the care of a medical man in a house with trained attendants selected by him, which is to be understood as the author's plan for the private treatment of the insane.

Several reasons are furnished for preferring the private method of treating cases of unsound mind:

"First, greater secrecy; second, the stigma of having been an inmate of an asylum is obviated; thirdly, patients recover quite as satisfactorily and more quickly if not compelled to mix with others similarly afflicted; fourthly, the exercise of a little care will, in many instances, insure the return of the patient to his home without any of his acquaintances becoming aware of the reasons that have led to his absence; fifthly, that each case receives more individual attention at the hands of the medical man and attendants employed, and there is a better chance of his getting the exact treatment suitable to his case, a practical impossibility in an institution numbering its patients by hundreds."

If for any reason the patient is not a suitable case for private treatment, the author prefers an excellent hospital for the insane to a private asylum.

Strangely enough, none of the reasons presented seem to have been founded on the results of professional experience definitely ascertained. They are rather a concession and deference to the private feelings and interests of the friends of patients which naturally exist, and to ill-founded traditional prejudice against established hospitals prevalent in the public mind. The chapters devoted to "Selection of Attendants," "Treatment," and "Tact," contain no suggestions which are not, or may not be, as well or better carried out in organized hospitals with a larger plant and resources, than any system of private treatment can afford. If, as is alleged, the insane person may awaken to reason and be shocked to find himself surrounded by the insane in a hospital, so it may be supposed he may awaken to find himself in a strange house surrounded by strangers, a close prisoner perhaps without the warrant or sanction of law. Both of these supposed awakenings may, however, be regarded as extremely hypothetical, as all experience shows that changes are usually gradual and not sudden.

The detention of insane persons, singly, in private houses is a responsibility that may be intrusted to a very limited number of persons without risk of abuse. Yet experience has shown that it is wiser and safer for all concerned that single, private care of the insane in houses, other than in their own homes, should have the sanction of law and the supervision of State officers. Of the results of private treatment of the insane the author has made no statement from which its value may be estimated. In the last report of the English Commissioners of Lunacy may be found the proportion of per cent. of recoveries to admissions for the year, which is presented in this connection:

| | | | |
|---|---|---|---|
| County asylums | 42.26 | Registered hospitals | 45.56 |
| Metropolitan licensed houses | 39.07 | Provincial licensed hospitals | 36.48 |
| Private single patients | 10.83 | | |

The book has no special suggestions or advantages to offer for the benefit of the insane of the indigent or middle class, but is in the line of improved care of the insane of the private class who are able and willing to pay a large weekly charge. It is also to be accepted as a mild protest against some of the acknowledged defects of the existing hospital system which time and improved plans will correct. J. B. C.

3. The name Bedlam is so inseparably connected with, and made a part of the history of the treatment of the insane, and so much that has

redounded to the credit of England's lunacy administration received its birth and impetus in the revelation of the practices of old Bedlam, that it seems eminently fitting that from modern Bethlem a clinical text-book should be evolved, replete with ideas and suggestions for the better care and treatment of the insane. As one of the editors of the *Journal of Mental Science*, the organ of the British alienists, Dr. Savage has for a long time been known as a man of progressive ideas; but it is, perhaps, as a clinical teacher at Guy's, and in the wards of his own hospital, that his work has been most effective, if not the most widely known.

The work under consideration is the result of an attempt to "take stock" of a mass of observations and deductions accumulated during the experience of twelve years as a superintendent of a hospital for the insane, and a lecturer on insanity, and, as would be expected, is of a very practical nature.

Dr. Savage is met at the outset by the same difficulty which all writers upon mental disorders have encountered, when he attempts to define insanity. From a medical standpoint, he says it is to be considered "a disease of the brain." Would not it be more in accordance with the facts to say a symptom of a disease of the brain? To borrow from the author's own words, "sanity" and "insanity" are words which we use to designate certain conditions, neither of which can be rigidly confined within the bounds of a definition, and as we regard sanity as the condition resulting from the normal action of a healthy brain, so we must consider insanity as the symptom of a diseased brain, and not as the disease. Dr. Savage says, in discussing this point:

"A man in fact must be considered as sane, or insane, in relation to himself. The old, and oft-repeated statement that insanity is a perversion of the *ego*; is absolutely true. Sanity and insanity, then, are to be measured by differences or changes of habit, taste, and disposition in the individual, as well as by other symptoms of change in the nervous centres. The difference will necessarily be seen to be not only one of degree, but one of time, so that a man being sane now may be insane within a longer or shorter period. I shall take it for granted that insanity depends upon change in the nervous structures of the body; but by no means shall I restrict the causation of insanity to changes in the brain alone. . . . . But the more I see of insanity the more convinced I am that the consideration of mental disorder can only be fairly approached by the complete consideration of general physiology—*i. e.*, the development, growth, and decay of the body in all its parts."

The subjects of eccentricity and genius are touched upon, incidental to the general subject of insanity. Eccentric people are divided into two classes: 1. Those having a neurotic inheritance, and who are, in fact, on the border-land of insanity, and 2. Cases developed *de novo*, who pass through life without any marked access of mental disturbance. The classification adopted by Dr. Savage shows at once that he approaches the subject from a clinical standpoint, and that he does not propose to lumber up his work or confuse his readers with the fine and unnecessary divisions and subdivisions so much affected by dilettante writers.

From our present knowledge of insanity and the pathological processes which lead up to it, it necessarily arises that any scheme of classification must be imperfect, and that various forms of mental disturbance will be found to belong—in some respects to one, in some respects to another division of the classification. In certain cases the etiological factors are so prominent that they are instinctively classified

according to their causes. In some symptomatic, and in others somatic features predominate, and until the time arrives when we shall have a clear knowledge of the pathology of insanity we must despair of a perfect classification. When that time arrives, if it ever does, then even we shall be met by the difficulty resulting from the fact that similar mental states may be caused by the same apparent condition of nerve disease or degeneration.

Dr. Savage groups his cases as follows:

"Hysteria—mania. Hypochondriasis—melancholia.
"Dementia, general and partial, primary and secondary.
"States of mental weakness—chronic mania and melancholia, recurrent insanity, delusional insanity, general paralysis of the insane.
"Paralytic insanity—epileptic insanity.
"Puerperal insanity—postconnubial, puerperal, lactation.
"Toxic insanity—alcohol, lead, opium, chloral, etc.,—gout.
"Visceral insanity—renal, cardiac, and pulmonary.
"Insanity with syphilis—myxœdema—Graves's disease—asthma—diabetes.
"Idiocy in its various degrees."

Before giving his own classification he gives that of the College of Physicians of London, which he calls the ideal classification.

The chapter on causes is an interesting inquiry into the assigned causes of insanity—predisposing and exciting, general and special.

Following the chapter upon causation, Dr. Savage takes up, in the order of his classification, the various forms of insanity and discusses them in an able manner.

The author is not only an able clinical teacher but an experienced pathologist. His experience in the wards of Bethlem and in the pathological laboratory have not led him to take a very optimistic view of our present knowledge of the pathology of insanity. He says in one of the earlier pages:

"I may say that, with my experience of years, and after seeing many hundreds of *post-mortem* examinations of the bodies of the insane, I have met with few coarse changes within the skull, and even with the higher powers of the microscope all that can often be detected may be evidences of change in the nutrition of the connective tissue of the brain."

As regards the future, he is more hopeful; he says:

"The time will come when the inter-relations between the millions of nerve cells with their manifold processes, and their dependence for healthy action upon healthy blood and pure air, will be better understood."

He likens the brain to the kaleidoscope, in which the pattern of the image changes while the parts remain the same, being simply changed in their relations to each other.

When will the physiologist or pathologist appear who shall teach us to recognize the characters and determine the causes of these changes of relation? And when shall we be taught how to restore the parts to their original pattern?

In view of the recent publication of Dr. Earl's work on the *Curability of Insanity*, Dr. Savage's remarks upon the subject are of interest:

"There is, in fact, a very strong feeling prevalent that a patient once having had an attack of insanity is never cured under any circumstances. This I shall oppose entirely; but I acknowledge that a very considerable proportion are maimed in one way or another by an attack of insanity."

In the matter of treatment, Dr. Savage will be found to agree in all essential matters with the practice of the better asylums of the United States. He is in favor of asylum care for the majority of cases, as affording the best hope of recovery. Of home care, he says that it is "only suitable for cases in which there is a hope of speedy recovery, and where there are judicious friends and sufficient space." Except in special instances he deprecates what is called "single care," and is convinced that other things being equal, more patients get well when associated with others than when under single charge.

The manual is written in a pleasing style and can be read by those even of large experience with profit. It will be found to confirm by its well-digested clinical facts a doubtful opinion in the minds of some or to correct a mistaken conclusion for others. For the general practitioner, it perhaps presupposes too much an elementary knowledge of the subject, which, unfortunately, the majority does not possess, but even the general practitioner will find the work of great interest and value.

E. N. B.

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La Langage Intérieur, et les diverses formes de l'Aphasie. Par Gilbert Ballet, Professeur agrégé a la Faculté de Médecine de Paris. Pp. xvi. 174. Paris: Germer Ballière et Cie, 1886.

Inner Speech and the Different Forms of Aphasia. By Gilbert Ballet, Associate Professor of the Faculty of Medicine in Paris.

On Aphasia; Being a Contribution to the Subject of the Dissolution of Speech from Cerebral Disease. By James Ross, M.D., LL.D. Pp. ii. 128. London: J. & A. Churchill, 1887.

Each of these attractive little volumes presents, in a clear and comprehensive manner, the results of recent investigations, both clinical and pathological, upon the interesting condition of disturbance of speech.

Ballet approaches the subject from the psychological side, and discusses the mental processes involved in spoken language. He shows that men differ from one another in the manner, as well as in the matter, of their thinking. Some listen to the ideas as they flow through the mind, hearing the murmur of the stream of thought (les auditifs). Others are spectators of a series of mental pictures, and are continually watching the changes that pass before the mind's eye (les visuels). Others still, can only grasp an idea by a sort of inward effort of articulation, a silent process which, in children, is often evident in the motion of the lips which accompanies early attempts at reading (les motifs). Thus, in our inward speech there are various elements, one of which predominates in every one.

This may become more evident if Charcot's analysis of the mental constituents of the idea "bell" be considered. This idea, like that of any other object, is made up of a number of mental pictures. There is the picture of the appearance of the bell—the visual memory; there is the picture of the sound of the bell as it rings—the auditory memory; there is the picture of the sound of the word "bell" when spoken—the word-hearing memory; there is the picture of the word "bell" as printed

or written—the word-seeing memory; there is the picture of the muscular movements necessary to say and to write the word "bell"—the word-uttering, and the word-writing memories. These pictures together form the complex mental image involved in the idea "bell;" and the same is true of the idea of any concrete object. It will be noticed that four of these mental pictures are sensory in their origin, and that two are motor. All are necessary to the perfect representation of the idea to the mind, or for perfect expression in speech. Aphasia, according to Ballet, consists of the loss of one or more of these mental pictures, and is sensory or motor according to the character of the image lost. Loss of visual or auditory memories is rare, and may not affect speech, although it is usually associated with aphasia. Loss of the word-hearing memory is known as word-deafness, or amnesia. Loss of the word-seeing memory as word-blindness, or alexia. Loss of the word-uttering memory constitutes aphasia proper. Loss of the word-writing memory produces agraphia. These forms may be combined in any one case, but often occur alone.

It is evident that the work of Ballet is founded upon the lectures of Charcot, recently collected and issued by Bernard ("De l'Aphasie et de ses diverses formes," *Le Progrès Médical*), and that its claim to originality, either of conception or presentation, is very slight. Nevertheless, it is clearly written, and as it is issued as a volume of the Bibliothêque de philosophie contemporaire, it may be regarded as a successful semi-popular presentation of the subject.

Ross takes up the subject of aphasia from the clinical standpoint, and gives most interesting and well-studied cases illustrating the varieties of the "dissolution of speech." He divides aphasia into a motor and a sensory form, but admits that these are frequently combined. Motor aphasia presents three varieties: (1) aphemia, which presents many degrees from a slight defect in the power of expressive speech up to absolute wordlessness; (2) agraphia, which may vary from a condition in which the patient makes mistakes in spelling and diction, up to a state in which he cannot write or copy a single letter; and (3) amimia, a condition in which gesture language is suspended, and which, so far as known, is a theoretical form not yet observed. Sensory aphasia also presents three varieties: (1) the aphasia of recollection, in which the idea of an object fails to revive its corresponding word; (2) psychical blindness, in which the visual image of the object is lost, or its word-image is lost (word-blindness), or even the letters of the alphabet are no longer recognized (literal blindness); or in which there may be a partial perceptive blindness, which is not, however, to be regarded as aphasia; (3) psychical deafness, in which the acoustic imagery is impaired, the words being no longer recognized when heard (word-deafness), or at the command of the memory when needed; and this in its extreme form may be partial perceptive deafness in which ordinary sounds, such as the tapping on a door, are no longer understood. Ross distinguishes four or five different degrees of each of these forms of aphasia, a subdivision which seems somewhat artificial, and complicates the subject unduly.

Paraphasia, in which the motor and sensory forms are combined, presents several degrees from the mere substitution of a wrong word for the right one, up to the condition in which the patient talks gibberish; the intermediate forms being the condition in which the patient is compelled

to substitute for the correct word a paraphrase of it, or a wholly inappropriate term, and the condition in which the patient fails to appreciate the right name when uttered in his hearing.

Paragraphia is described as the condition in which the individual is unable to write correctly, or to write a continuous sentence, or to write a single word, or to copy.

Paralexia may consist of a transposition of words in reading aloud, which may be so extreme as to result in a gibberish altogether unintelligible to the listener.

Each of these forms is shown to have as a pathological basis a definite lesion in the brain at one part or other of the cortex. Motor aphasia is caused by a lesion of the left third frontal convolution. Agraphia is produced by a lesion in the second frontal convolution. Word-deafness is due to destruction of the first and second temporal convolutions in their posterior part. Word-blindness is produced by a lesion of the inferior parietal lobule and angular gyrus. Paraphasia, paragraphia, and paralexia are ascribed to lesions involving two convolutions in distant parts at once, or to a very large lesion involving an extensive area of the cortex. The usual explanation of these latter forms, urged by German authorities, is that they are due to destruction of the nerve fibres which pass beneath the cortex and associate the various areas with one another; but Ross does not favor this view.

The latter half of the book contains a careful critical study of the various explanatory schemes which have recently been offered by writers on aphasia; those of Kussmaul, Charcot, Lichtheim, and Broadbent being shown and discussed. To any one who cares to enter upon a minute study of aphasia, and to learn the many important bearings of the subject upon the psychological problem of the relation of mind and brain, this part of the work will be of great interest and value. Ross follows Hughlings Jackson very closely in his development of the theory of the evolution and dissolution of speech. The originality of the author is not however lost, and his critical insight and wide clinical experience combine to keep the discussion within medical lines. The easy diction and attractive style make the work an entertaining addition to the literature of aphasia.

M. A. S.

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DEPARTMENT OF THE INTERIOR. BULLETIN OF THE UNITED STATES GEOLOGICAL SURVEY, No. 32. MINERAL SPRINGS OF THE UNITED STATES. 8vo. pp. 235. Washington: Government Printing Office, 1886.

ALTHOUGH the number and extent of the so-called mineral springs of the United States are never realized till one reads this Bulletin of the United States Geological Survey, a careful perusal of the results there obtained go to show that the number of springs possessing any real value as medicinal agents is comparatively small.

Many of the so-called hot springs have been found to possess no larger amounts of mineral matter than ordinary indifferent waters, and largely depend on their heat for any therapeutic powers which they may possess.

The chief value to the ordinary medical practitioner of a publication of this kind is to enable him to discover whether or not springs possess-

ing powers for good exist in accessible regions in this country, and whether, if accessible, they approach the foreign waters closely enough to be substituted for them.

The space allotted to a review of this character does not permit of an extended comparison of the mineral waters of this country and abroad, and for this reason only the most important will be considered.

Roughly stated, the springs which are generally looked upon as valuable for medicinal purposes contain one or more of the following ingredients; namely, sulphur, chalybeate matters, arsenic, salines, and sulphuric acid, and perhaps lithium. Suffice it to state that in the United States we have waters possessing all these properties to a marked degree. Not only have we springs in this country which to a large extent may be used in place of European waters, but in some instances the springs of the United States actually surpass in a considerable degree those of other countries. Thus, the so-called saline springs, such as Saratoga, compare very favorably with corresponding waters on the other side, while the Balston springs of New York not only surpass all foreign springs in mineral constituents (135 grains per pint), but also excel the saline waters of Homburg, Kissingen, Wiesbaden, and Selters in their percentage of carbonic acid (53 cubic inches). Not only does this remarkable spring contain these constituents in such large amount, but it also possesses a large proportion of the carbonate of lithia—0.701 of a grain.

The springs of the United States corresponding most closely to the celebrated ones abroad are, probably, the following:

Sulphur springs: Lower Blue Lick, Nicholas Co., Ky.; Sharon, Schoharie Co., N. Y.; White Sulphur, Greenbrier Co., Va.; Salt Sulphur, Monroe Co., W. Va. Epsom salt: Bedford, Bedford Co., Pa. Sodium chloride: Hathorne, Saratoga, N. Y.; Balston, Saratoga Co., N. Y. Iron: Oak Orchard, Genesee Co., N. Y.; Rockbridge Alum, Rockbridge Co., Va.; Cooper's Wells, Hinds Co., Miss. Glauber salts: Crab Orchard, Lincoln Co., Ky.; Midland, Midland Co., Mich.

As regards the geographical distribution of mineral springs in the United States, it is found that of the Eastern States, New York and Virginia have the largest number of active medicinal waters, while the States and Territories west of the Mississippi River contain nearly all the important thermal springs we possess, with the exception of a few scattered along the Appalachian chain in Virginia and one at Lebanon, N. Y.

It is probable, too, that large numbers of the so-called medicinal springs do not possess constituents capable of acting in any way directly on the organism but rather do good by "sluicing" the renal organs and thereby aiding elimination, or, when used in baths, by increasing the action of the skin.

In conclusion, the labor involved in such a report can scarcely be estimated, and those having it in charge are to be congratulated on presenting the public with so interesting and valuable a compilation. The benefits of such publications have already been partially pointed out, and are too obvious to need further comment. The only fault that can be found with it is in the index, which, while good and copious, gives only the name of each spring without stating its chief constituent, and, as a consequence, one is forced to look up many references before he is able to find any number of a given variety of waters for comparison. Under

the act of Congress, this Bulletin can be obtained by enclosing a money order for 20 cents to the Director of the United States Geological Survey, Washington, D. C. H. A. H.

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TRANSACTIONS OF THE AMERICAN OPHTHALMOLOGICAL SOCIETY. TWENTY-SECOND ANNUAL MEETING, 1886. 8vo. pp. 220. Boston, published by the Society.

THIS second part of the fourth volume is the largest annual contribution which the Society has yet made to its transactions, and the matter it contains makes it by far the most important American contribution of the year to the literature of ophthalmology; many of the papers, too, are of general interest.

The retinal lesions connected with albuminuria are extensively discussed: Dr. C. S. Bull contributing an "Analysis of One Hundred and Three Cases of Exudative Neuro-retinitis Associated with Bright's Disease;" Dr. George C. Harlan, a case of "Thrombosis and Perivasculitis of the Retinal Vessels;" and Dr. S. D. Risley a case of "Albuminuria of Pregnancy; Retinitis; Induced Premature Delivery."

Bull excluded all cases due to scarlatina or pregnancy, and reported only such as he had been able to follow to their termination, or to the date of the report. His patients included fifty-six men and forty-seven women. Both eyes were affected in ninety-three cases; hemorrhages occurred in one or both eyes of sixty-nine patients; while all but three came to present evidence of cardiac hypertrophy with or without valvular disease. In thirty-two cases vision improved under treatment, but without absorption of the glistening exudation at the macula.

In this series of cases the gravity of the prognosis is well illustrated. Thirty had died within six months after they were first seen, and in the next six months twenty-seven more. In the second year eighteen died; in the third year, six; in the fourth year, four; and in the sixth year, one. Of the seventeen still living, fourteen had been first seen within the last six months; two others within a year; and only one had been first seen seven years ago. In the discussion Dr. Gruening stated that of one hundred cases he had collated, none had lived more than two years.

For those cases arising from scarlatina, and especially in those from pregnancy, the prognosis is entirely different. This is well illustrated in Dr. Risley's case, where the patient, after being almost blind, with the urine loaded with albumen, and after premature delivery becoming unconscious and hemiplegic, and subsequently exhibiting aphasia, made an excellent recovery, vision coming up in the right eye from counting fingers at two feet to $\frac{20}{xxx}$, and in the left from $\frac{10}{cc}$ to $\frac{20}{xx}$; while the very extensive retinal exudation disappeared entirely from the latter, and left but a few splotches on the eye-ground of the former.

Dr. Harlan describes a case of almost universal change in the retinal vessels of one eye, with small hemorrhages and other slight retinal changes in the other eye, in a patient who shortly afterward had albu-

minuria and partial left hemiplegia. The case is illustrated by a plate showing the appearance of the fundus; the darker red of the normal vessels being replaced by broader bands of glistening white.

It has from time to time been remarked that "Listerism" and the "gospel of cleanliness" seem to arouse no general interest among ophthalmic surgeons. The reason doubtless is, that it has never been customary to invite assistants to thrust their dirty hands into the corneal incision; while the dictum of high authority forbade the introduction of any instrument not absolutely necessary, and the necessity for perfectly keen edges, and smooth-working joints invites to scrupulous cleanliness of such instruments as must be introduced. Then, too, the constant bathing of the eye by the lachrymal secretion, and the outpouring of the aqueous humor through any corneal incision tended to prevent infection. So that the ophthalmic surgeon practised asepsis, as the rustic talked prose, without knowing it. But although this was generally true, it occasionally happened that in the most promising case, after the neatest operation, an eye would be lost by general purulent inflammation; indicating, that to be right by chance, is not so safe as to be right by definite knowledge. Attention is called to the subject by Dr. H. Knapp, by some "Remarks on Pyogenic Microörganisms, with Demonstrations and Experiments." The demonstrations included the making of cataract extractions upon the eyes of four rabbits; on the left eyes with clean instruments, on the right with instruments contaminated with staphylococci. The operations were rudely done, and the injury to the left eyes increased by stirring the deeper parts with a sterilized hook. Yet while the right eyes all showed free suppuration when exhibited twenty-four hours later, three of the left eyes remained free from suppuration throughout, and the fourth, showing it at a later date, was believed to have been contaminated by the right eye of another rabbit kept in the same box, so that their heads were in close contact. Dr. Knapp believes that for eye surgery smooth-cutting instruments are best sterilized by washing in clean water, and wiping and polishing on a clean towel; because any efficient antiseptic solution is likely to dull a cutting edge. Tarnished instruments cannot be cleaned in this way, and rough instruments must be placed in some antiseptic solution.

Cataract extraction has its usual share of papers and discussion. Dr. G. Strawbridge offers a "Report of Two Hundred and Sixty-one Cases;" Dr. H. Knapp, a paper on "Cataract Extraction without Iridectomy;" Dr. D. Webster, "Report of Fifty Cases of Cataract Extraction with Remarks;" Dr. H. D. Noyes, "Extraction of Hard Cataract—Death on the Fifth Day—Examination of the Eye." The principal interest in these papers and the extended "discussion" which follows them, attaches to the operation of extraction without iridectomy, as to which there is an agreement that its value and the classes of cases to which it is suited are not yet fully determined; to the washing out of the conjunctival sac and the anterior chamber with antiseptic solutions, which is recommended; and to the use of cocaine for operations threatening the integrity of the cornea.

Bearing on the latter point several speakers report bad effects from the free use of strong solutions. But there seems to be a general agreement that smaller quantities, as a drop or two of a two or four per cent. solution, answer the purposes of a local anæsthetic about as well and are free from danger. It is to be feared that the danger which cocaine

brings to the non-vascular cornea, both by the anæsthesia which allows the unrecognized presence of irritants, and the lessening of its nutritive supply by contraction of the neighboring vessels, is not yet sufficiently understood by many who prescribe it. Recently the writer has seen tedious and very painful inflammation of the cornea with extensive superficial sloughing and consequent opacity, caused by frequently repeated applications of a four per cent. solution of cocaine to relieve the pain of an acute catarrhal conjunctivitis. The attending physician had ordered the solution to be used at considerable intervals, the patient found it gave relief, which was of short duration, and repeated the application with each recurrence of the pain. There resulted the loss of most of the surface of the cornea, leaving an exquisitely painful ulcer and permanent damage to the sight.

Returning to our subject, we find a paper by Dr. B. E. Fryer on "The Use of Hot Water in Some of the Conjunctival and Corneal Inflammations." Not warm, but hot water is to be used. He says:

"I was astonished in the earlier cases (it being new experience to me) at the tolerance and even indifference to the heat by the patient. Water in which I could not retain my hand a minute, apparently made no unpleasant impression on individuals who had used it at the same temperature for a few hours or for a day or two. The temperature of the water should not be lower than 140°, and as much higher as can be tolerated; of course, short of blistering."

Its use was recommended in purulent and catarrhal conjunctivitis, phlyctenular ophthalmia, and in corneal inflammations and ulcers. It is especially effective in relieving the pain of the latter. Dr. Fryer's estimate of such treatment is confirmed by other members.

Dr. Wm. F. Norris offers "Some Remarks on Asthenopia and the Changes in Refraction in Adolescent and Adult Eyes," including the report of a series of cases of hypermetropia diminishing or passing over into myopia. He regards diminishing hypermetropia and increasing myopia as different stages of the same process; and "would urge, therefore, the careful correction of every case of ametropia where there is accompanying asthenopia." "All such cases should be carefully measured under a strong mydriatic, as it is impossible to correct them accurately without it." While under the influence of the mydriatic the eye should be protected by dark glasses, lest the excess of light "cause a low grade of chorio-retinitis, which it is much easier to call into existence than to cure."

Dr. J. A. Andrews contributes a paper on "The Electric Light as an Illuminator—The Effect of Strong Light on the Eye;" based in part on the examination and observation of eleven hundred persons habitually working by the light of the incandescent lamp of Edison. From his conclusions, we quote:

"The *arc light* in its present state should be positively rejected as unsuitable and actually harmful to the human eye, particularly on account of its steadiness. The *incandescent light of Edison*, because of its steadiness, adequate power, and composition, is safe, and occupies at present the first position as a means of artificial illumination."

Dr. W. F. Mittendorf gives an account of "Two Epidemics of Molluscum Contagiosum," a skin disease, interesting the ophthalmologist by its predilection for the eyelids. These epidemics, including nearly

one hundred cases, throw some light on the mooted question of the contagiousness of this affection.

Reports of cases; and descriptions of new instruments, tests, and procedures; with a couple of papers on geometrical optics, occupy the remainder of the volume. E. J.

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L'AMPUTATION DU MEMBRE SUPÈRIEUR DANS LA CONTIGUITÉ DU TRONC. (AMPUTATION INTERSCAPULO-THORACIQUE.) Par PAUL BERGER, Chirurgien de l'Hôpital Tenon, Professeur Agrégé a la Faculté de Médecine, Membre de la Société de Chirurgie. G. Masson: Paris, 1887.

INTERSCAPULO-THORACIC AMPUTATION OF THE UPPER EXTREMITY. By PROF. PAUL BERGER. Paris, 1877.

1887

THIS monograph by Prof. Berger is a treatise upon amputation of the upper extremity and scapula, either at one operation, or in consecutive periods. He designates this procedure as "Interscapulo-thoracic amputation," but it is usually spoken of as amputation above the shoulder-joint. The book, which is written in the French language, contains 371 pages, and is illustrated with several woodcuts and two colored lithographic plates. The style is simple, and can be readily understood even by one whose knowledge of French is not great.

The author states that the meagre notice of this operation which is found in the classical treatises upon operative surgery, renders it desirable that a thorough study of this subject should be undertaken, since the operation, though not often required, does in some, otherwise desperate, cases afford an effective resource. The histories of fifty-one cases culled from literature or from the personal experience of the author are recorded, and form the basis of the excellent critical remarks which follow. The operation is altogether modern, the earliest case recorded being that performed by Ralph Cumming, a surgeon in the English Navy, in 1808, though Cheselden figured a cured case of accidental ablation of the upper extremity and scapula in his *Anatomy of the Human Body*, published in 1768.

After giving the details of the different operations which have been performed, the author considers the subject from various standpoints, such as the mortality inherent to the operation, the causes of death, the accidents occurring during and after the operation, the indications for the operation, and the remote consequences which may follow it, and finally general considerations upon operative technique. The mortality varies with the nature of the affection for which the operation is performed, thus, in those cases where amputation is performed for pathological causes the mortality is about 20 per cent., whilst in traumatic cases 30¾ per cent. die. The mortality of primary operations, in which the arm and scapula are removed at the same time, is about the same as in secondary operations where the shoulder blade is removed some time subsequent to the primary operation. This is rather an exceptional fact, as it is a common observation that a primary amputation at a certain height is usually more fatal than a secondary operation performed at the same level. Amongst the immediate results which may

occur are hemorrhage, the entrance of air into the veins, shock, and purulent infection. Air has found entrance into the axillary vein upon four occasions, as was announced by a peculiar gurgling sound and followed almost immediately by alarming sycope. All these patients recovered from this accident with one exception.

This operation has been performed for tumors of the humerus and scapula, usually malignant in character, for osteitis, and gunshot wounds. Of the fifty-one cases reported eleven were done by American surgeons; the first complete ablation of the upper extremity, scapula, and greater part of clavicle at one operation, was performed by Dr. Dixi Crosby of the United States, in 1836. In conclusion, this thesis contains about all that is known upon this subject, and a careful perusal of its pages will be both interesting and instructive. R. W.

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BEFORE TRIAL. WHAT SHOULD BE DONE BY CLIENT, SOLICITOR, AND COUNSEL. By RICHARD HARRIS, Barrister at Law. TOGETHER WITH A TREATISE ON THE DEFENCE OF INSANITY. London: Waterlow Bros. & Layton, 1886.

THIS small volume of less than three hundred pages, is neither more nor less than it professes to be. This in itself is a virtue. It is written in a pleasantly clear and concise style. It is intended for lawyers, and, as a whole, therefore, need not be fully considered here; but, as the latter part is quite as much for the doctor as for the lawyer, we refer to it. In Chapter XVII. we have the introduction to the defence of Insanity, and in the following 60 pages the test questions, the value of the decision in the McNaghton case, and the evidence of insanity and medical authority are discussed.

The note of the introduction is very unlike that sounded by most barristers, and our profession must welcome a man who is not tied and trammelled by authority. He maintains that it is justice that is wanted, the true relationship of the established facts and not the opinions of the long dead and forgotten. He says, "I have always felt that the medical profession is too little regarded in this question of insanity. Medical men are the very best, nay, they are almost the only persons capable of pronouncing a trustworthy opinion on the subject. They are too often ignored, as if they always came to get a prisoner acquitted, and as if they had a motive in so doing." We agree with this, but like our authority, we must object to authority, for it is only resting on authority, to suppose that any medical man can on general principles decide on insanity: only those can speak with any degree of force who have lived with or had many opportunities of studying nervous disorders in the insane.

In Part I. our author instructs the solicitor in his preparation of the brief when the plea of insanity is raised, and, in passing, one may say, all the evidence really is taken as if a crime is the only point ever to be considered in relationship to insanity. If our author would treat the question of validity of wills and devising capacity as well as he has the evidence in criminal trials, he would be a public benefactor.

In giving directions for taking evidence on insanity, Mr. Harris shows practical knowledge and clear insight. He reflects the popular opinion that the plea of insanity must be a last resource. As evidence of the uncertainty of the relationship of symptoms, he points out that conditions or states of unconsciousness, whether due to somnambulism, to epilepsy, or drink, may render a man ignorant of his act, and yet, while for the one a man may be considered responsible, for the other he is not.

Drunkenness is no excuse, but insanity produced by drink is; this certainly is an anomaly, for the single lapse may land a man on the gallows, while habitual intemperance may send him to an asylum.

Our author gives examples showing that one cannot decide as to responsibility by proving whether a man's mind went with the act or not, and proceeds to emphasize his belief that the defence must depend on common sense and not on technicalities; no definition of madness can possibly be made, and, therefore, it is best not to attempt to do more than lay facts, not definitions, before the jury.

No reliance is to be placed on whether a man knew or did not know that the act he was perpetrating was wrong, and the misconception of the whole question by judges is attributable, first, to universal incapacity to define insanity, and, secondly, to total misconception by the judges of what insanity is. The tendency of judges to "follow my leader," and to continue in doing unreasonable things because their predecessors did them, is forcibly exposed.

Very properly he points out the utter folly of supposing that any one test can be applied to all cases, and he shows that the fact that a policeman near at hand having a restraining influence is not conclusive evidence of criminal rather than insane intention.

"Madness has never been incompatible with knowledge except in legal minds," sums up the judgment of most lawyers on mental disorder. The test of "self restraint" being proved to be a false one, the test of knowledge of "right and wrong" is discussed and discarded as being only "the policeman at the elbow again."

"It is enough to say in answer to all such unscientific tests that insane people, like others, are subject to fear; that they refrain from committing certain deeds because they know they are wrong and that they will be punished if they commit them; and they sometimes refrain because they are under the delusion that a policeman or keeper is watching them."

Mr. Harris sees clearly that the only thing to be really decided is, whether the prisoner is sane or insane, and if he be decided to be insane nothing more should be needed. Doctors alone should decide or produce facts proving this, and they should be able to consider the facts of the man's life and inheritance, and not merely the conditions associated with the criminal act, though the crime itself is often the most marked evidence of insanity.

With all the support given to the medical witness, his weaknesses are also pointed out. "The moment medical men take sides they are useless" is a perfectly true statement of what, we regret to say, is a common occurrence.

In Part II. we have a very full discussion of the points in the McNaghton case, and as these are more for lawyers than for doctors we pass them over, only saying the whole is very trenchantly and logically considered, and all in favor of experience and common sense.

Part III. is eminently practical, showing the kind of evidence which should be produced and giving its relative value. He advises that in the brief, facts of eccentricity or injury should take the place of theory. Sunstroke in India is treated as sceptically by juries and judges as it is by asylum physicians and had better not be trusted to.

It is only for us to say that our author has a very thorough grasp of the relative value of medical indications, laying much stress on such conditions as epilepsy and neurotic inheritance. He does not quite make clear, however, that there may be brain disease without mental disorder, and we feel it would be unwise to loosen his faith in the fixed and determined connection between mind and matter lest he should become half-hearted in the future in the defence of our professional knowledge. And now we must leave this book with a very sincere hope that it will be widely read by both lawyers and doctors.

We are inclined to think in one way that it is too long and in another it is defective, and our desire would be that the more useful and practical parts should be retained in any future edition, but that the discussion on the McNaghton case and the judges' opinions should be enlarged upon and printed apart, and that other points, such as disposing and contracting capacity, should be treated.

The author would thus give us a good handbook of great medico-legal value.

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THE HYGIENE OF THE VOCAL ORGANS. A PRACTICAL HANDBOOK FOR SINGERS AND SPEAKERS. By MORELL MACKENZIE, M.D. Lond. Third edition. 12mo. pp. 230, illustrated. London: Macmillan & Co., and New York, 1887.

As, according to the preface, every singer or actor of note in Great Britain, with hardly an exception, has at one time or another come under the author's hands, it was to be expected that his Handbook would have a large circulation; and so a third edition has been issued within a few months of the issue of the first.

Being intended for the general public, little note is requisite in this journal. While information and advice are given to singers and speakers with considerable detail, exception is taken as to the necessity for their knowing anything about the anatomy and physiology of their vocal and articulating organs. Amid occasional exhibitions of good, dry humor, we notice with surprise some undignified pseudocaustic raillery —*i. e.*, against teachers and others who have endeavored to go over the same and similar ground, and with whose views and results there is some discordance in the context. Pictures 12 and 13, of the appearances of the glottis in the head and falsetto registers, with an elliptic opening in the middle third of the glottis, must surely be exceptional.

Like all the advice given by Dr. Mackenzie to his colleagues, the advice given to his patients and their class is in this book good and commendable; and to English-speaking physicians treating singers and speakers, it will be of almost equal value. J. S. C.

DISEASES OF THE EAR, AND THEIR TREATMENT. By ARTHUR HARTMANN, M.D. (Berlin); translated from the third German edition by JAMES ERSKINE, M.B. 8vo. pp. xiv. 283. Edinburgh: Young J. Pentland. New York: G. P. Putnam's Sons, 1887.

IN the translator's preface we find that "this translation has been undertaken with the view of placing in the hands of English practitioners and students a book specially suited to their requirements." If it had been said that the task was undertaken in order to place before English readers one of the best German works on otology, we should not have demurred. We must, however, enter our protest against the suggestion contained in the above sentence, that there are not many excellent works written by English and American authors in their mother tongue. The names of many such will at once present themselves to the reader if he is interested in aural surgery.

Dr. Hartmann's work is, however, excellent, and as a book of reference most valuable. At the same time, we venture to doubt whether it is sufficiently elementary for the student or young practitioner who has not had the advantage of clinical instruction in otology.

We are glad to see that in discussing "otitis externa diffusa," the view is expressed that this affection is commonly either secondary to inflammation of the middle ear, or due to irritants—chemical, thermal, or mechanical.

With reference to exostoses of the meatus it seems to us that the author contradicts himself in the following sentences, which have been verified by consulting the German work: "This [*i. e.*, treatment] is limited to removal of obstructing matter so long as the contraction is not very great, and the dulness of hearing is only caused by temporary obstruction of the space which exists." . . . "As a rule, the exostosis should be removed as early as possible, especially if still growing, as the operation is more easily performed the less the meatus is occluded."

The advice given on page 145 is perhaps not quite in accordance with the views of English and American aurists, many of whom regard the use of bougies for the Eustachian tube with suspicion if not distrust.

In the section on "Chronic Inflammation of the Middle Ear without Exudation," we find the various methods of treatment discussed; we would, however, take exception to the statement that "vapor of chloride of ammonium, which has been in use for a long time, is now rarely employed." We think that one of the forms of chloride of ammonium inhalers now in common use, is likely in such cases—provided always the case is or has been of catarrhal origin—to be of great service after thorough patency of the Eustachian tubes has been secured. At the conclusion of the same chapter the author says: "If no benefit can be obtained by the above modes of treatment, operations must be resorted to." This is dangerous advice, doubly dangerous when it appears in a work written for students. The operations, afterward referred to, are some of them perilous, and most of them commonly useless—*e. g.*, paracentesis by the galvanic cautery, tenotomy of the tensor tympani, and excision of the membrana tympani and ossicles. We believe that this last-named proceeding may have a future before it, but we maintain that the time has not come when it can safely be recommended in an

elementary work; neither do we yet know how to diagnosticate cases with sufficient accuracy to enable us conscientiously to recommend it.

Notwithstanding these few strictures we have felt obliged to make, we say again, as we said before, that Hartmann's work is, on the whole, most excellent and trustworthy.

The English edition reflects great credit on the publisher, paper, illustrations, and type being all equally praiseworthy. We are sorry to say that the translator might have done his work better. In not a few places the sense is not the same in the English as in the German work. Thus, on page 114 (English edition) the following sentence occurs: "Usually in cases of perforation [*i. e.*, of the membrana tympani, Rev.], with a knitting-needle, the consequent pain, tinnitus, dulness of hearing, and perhaps fainting occur only at intervals." The error here lies in the fact that in translating the words "nur vorübergehend," the writer has used as their English equivalent "only at intervals," whereas the sentence should run "only transient . . . occur." We have no doubt that if a second English edition should be required the translator will correct this and other similar mistakes (of which we regret to say there are not a few). We would also suggest that more attention should be paid to English composition. The following may be a literal translation, but it retains too much of the German idiom (not unmixed with a Scottish element) to be altogether acceptable to the taste of an English reader: "Therefore ought we always to open the antrum freely along with the neighboring cells" (p. 190).

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HANDBUCH DER ALLGEMEINEN UND SPECIELLEN ARZNEIVERORDNUNGSLEHRE. Auf Grundlage der neuesten Pharmacopœen. Bearbeitet von DR. C. A. EWALD. Elfte neue umgearbeitete und vermehrte Auflage. Berlin: Verlag von A. Hirschwald, 1887.

HANDBOOK OF GENERAL AND SPECIAL THERAPEUTICS. By DR. C. A. EWALD.

THE object of Professor Ewald in writing his now well-known work was for the purpose of providing his medical brethren with a book on formulary, rather than a text-book, on the use of drugs in disease. Every page teems with prescriptions, and the text, while showing a widespread knowledge of therapeutical literature, is cramped and dwarfed in the endeavor to introduce a multitude of formulæ.

The pharmacological literature of every civilized nation has been drawn upon, so that nearly every prescription has appended to it the name of its originator, while the consideration of the uses and actions of the drugs has been taken from the pharmacopœias of all nations possessing an official work on medicaments. The very fact that this book has reached an eleventh edition shows us, however, that empiricism is as rife in Germany as at home, and that a very large class of practitioners of medicine still treat their patients by the shotgun method rather than by stern reasoning and logic.

As a work on formulary Ewald's book certainly distances all com-

petitors, and although the labor involved in its construction must have been enormous, the author certainly cannot complain that his efforts have not been appreciated. H. A. H.

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HIP DISEASE IN CHILDHOOD, WITH SPECIAL REFERENCE TO ITS TREATMENT BY EXCISION. By G. A. WRIGHT, B.A., M.B. Oxon., F.R.C.S. Eng., Assistant Surgeon to the Manchester Royal Infirmary; Lecturer in Clinical Surgery in the Owens College, etc. 8vo. pp. 239. With 48 original woodcuts. London: Longmans, Green & Co., 1887.

IN noticing this monograph, dealing with so many questions which, despite all experience and research, are still moot points, it will be impossible to do more than touch upon a few salient ones.

As the author has performed, between October 30, 1880, and July 8, 1886, one hundred excisions of the hip, we are warranted in concluding that he trusts but little to nature in morbus coxæ. A very fair *résumé* is given of the pathological views of all the more prominent writers who treat of hip disease, and the conclusion is arrived at "that all cases of true chronic hip disease are truly tuberculous." The chapter on "Symptoms" is full, but we can only note that swelling of the inguinal glands indicates osteitis of the pelvis rather than the femur; that "nearly every case of chronic disease of the hip," if examined "at a certain period of its course," will "be found to contain pus;" and that the disappearance of abscesses is sometimes to be accounted for by their discharge through the rectum, which "is commoner than is supposed." The belief is expressed "that chronic hip disease begins invariably, or nearly so, as an ostitis," and that "cases of true hip disease rarely recover without entire destruction of the upper epiphysis of the femur, usually accompanied by abscess, and always result in shortening, with more or less deformity, and a very large majority die; very few reach adult life." . . . When the following sentences are read it will be seen exactly what the author's views as to treatment really are: "I agree that abscesses should be opened, but as there then remains what is practically a sequestrum as the source of the abscess, I think it should be removed—*i. e.*, the upper end of the bone excised (except in cases of residual abscess. . . . );" in other words, he advises treatment by rest and extension, but if an absess forms despite this, excise in all cases. Again, "treatment short of excision when once suppuration occurs, is useful only as a palliative, or a means of temporizing." In justice to the author we must say that although he has excised in about one case out of every *six seen*, he believes that such radical treatment will not be so often required in other than hospital patients. As to the method of operating, he prefers to saw off the bone in situ through the trochanter, and then disarticulate the fragment. The elastic bandage is thought useful in the after-treatment where there is much thickening of the soft parts, or the sinuses remain "flabby and sluggish." The mortality of Mr. Wright's excisions, he contends, amounts to only three per cent., explaining two other deaths by a preëxistent pyæmia. Amputa-

tion, either before or after excision, is shown to be more applicable than is usually taught, and the implied advice is given that even with extensive pelvic disease nearly one-half of the pelvis may and should be removed after a preliminary ligature of the common iliac artery. In the appendix are given the history of a number of cases of special interest, and a very full bibliography of the subject.

Our space forbids anything like an analysis of Mr. Wright's work, which certainly advocates the most heroic treatment of this lamentably frequent disease. Those who desire to study hip disease, from an almost purely operative point of view, should read this book, but for ourselves we can only say that, being not quite so much of a pessimist as Mr. Wright evidently is, we have more faith in conservative treatment than he has, and would warn those who read his book that the views held are so extreme as to demand more proof than he has adduced in support of his position. C. B. N.

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ANALYSIS OF THE URINE, WITH SPECIAL REFERENCE TO THE DISEASES OF THE GENITO-URINARY ORGANS. By R. B. HOFMANN, Professor in the University of Gratz, and R. ULTZMANN, Docent in the University of Vienna. Translated by T. BARTON BRUNE, A.M., M.D., etc., and H. HOLBROOK CURTIS, Ph.B., M.D., etc. Second edition, revised and enlarged. 8vo. pp. 310, with notes. New York: D. Appleton & Co., 1886.

IN the Journal for January, 1880, we noticed the appearance of the first edition of the translation of Hofmann and Ultzmann's admirable work on the examination of the urine, and expressed an opinion of the worth of the original, which we still entertain. The present edition embodies the advances which have been made in the technique of examination of the urine since the first edition was prepared, and no small part of this work has been contributed by the translators. An example of the share they have taken in bringing the work up to date is found in the chapter on albumin, which, we regret to see, they still call "albumen." In doing this, they translate the German "*Eiweiss*" literally; but it is of some importance to note that the albumin found in urine is not albumen (egg-albumen).

The translators, also, use the word "cylinders" for what are universally known in English and American books as "tube-casts." This we consider an error of judgment.

We might multiply examples of too literal translation from the German in this work; but we are happy to say that the present edition is so much an improvement upon its predecessor that we cannot repeat our former comment upon the familiarity of the translators with the language in which it was first written. On the contrary, it gives us pleasure to note that many of the lapses contained in the first edition have been corrected in this one, and to commend the smoothness which marks it in general. As to the intrinsic merits of the book, we need say little. But we can say that it is one of the best and clearest works on the examination of the urine with which we are acquainted. In the part devoted to the clinical application of its teachings it is exceptionally good. C. W. D.

DIE URSÄCHLICHEN MOMENTEN DER AUGENMUSKELLÄHMUNGEN: DIE NICHT-NUCLEAR LÄHMUNGEN. Von L. MAUTHNER, K. K. Universitäts Prof. in Wien. Wiesbaden, 1886.

THE CAUSAL CONDITIONS OF MUSCULAR PARALYSIS OF THE EYE: NON-NUCLEAR PARALYSIS. By PROF. L. MAUTHNER.

IN the number of this journal for October, 1885, we noticed the twelfth instalment of Prof. Mauthner's clinical exposition of eye affections, which was devoted entirely to the nuclear paralyses of the ocular muscles. This, the thirteenth number, is a continuation and conclusion of his study of the causes of ocular paralyses, and is given to the cortical and fascicular, the basal, the orbital, and peripheral paralyses. Together, the two constitute by far the most thorough and elaborately wrought-out study of the etiology of eye paralyses that has ever been published; and implying, as the major part of these paralyses do, lesions within the cranial cavity and a direct or remote manifestation on the part of the other divisions of the nervous system, they are of more interest and importance to the physician than ophthalmological studies usually are. We therefore direct the attention of students of the nervous system to those brochures, and predict for him who is fortunate enough to peruse them, a great pleasure in following out the keen, and close analysis of symptoms which is so characteristic of the writings of Prof. Mauthner.

Space is lacking for more than a simple citation of one or two salient points. In speaking of paralysis of the third pair, for example, if the branches to the iris and ciliary muscles remain free while there is at the same time contra-lateral hemiplegia, the diagnosis is fascicular paralysis; if, however, there is total paralysis of the third pair, it argues a circumscribed alteration at the peduncles at the exit of the oculomotorius, or a change extending from the pedunculus to the third ventricle, or the pathological change may be only basal.

Relapsing oculo-motor paralysis is considered in great detail, and an analysis of all the published cases given. The conclusion from a study of these cases is, that it is basal in its character, and due to a slowly developing pachy- or lepto-meningitis. He also points out as a matter of the highest practical interest, that double-sided ophthalmoplegias of an intracranial nature can be developed acutely or subacutely, and can disappear in a relatively short time.

Homonymous hemianopia, with unilateral nerve paralysis, can come from nuclear or basal changes. Amaurosis of the corresponding eye alone, or in conjunction with temporal hemianopia of the second eye, agues a basal change certainly. The orbital and peripheral paralyses are dealt with in the same exhaustive manner, but being of more especial interest to the ophthalmologist, we shall not dwell upon that part, simply commending them for the force and clearness with which the various points are put.

S. M. B.

# QUARTERLY SUMMARY

OF THE

# PROGRESS OF MEDICAL SCIENCE.

## ANATOMY.

UNDER THE CHARGE OF

GEORGE D. THANE, M.R.C.S. ENG.,

PROFESSOR OF ANATOMY AT UNIVERSITY COLLEGE, LONDON.

### THE CONSTITUTION OF THE RESTIFORM BODY.

W. BECHTEREW has studied the development of the restiform body in a series of fifteen brains, from various periods of fœtal life. He finds that this body is made up of five constituents, which are enumerated in the order of acquiring their medullary sheath: 1. The direct cerebellar tract of the cord. 2. Fibres springing from the nucleus of the funiculus cunextus of the same side. 3. Fibres springing from the lateral nucleus of the same side. 4. Fibres issuing from the nuclei of the funiculi graciles of both sides; the set derived from the nucleus of the same side ascend to the restiform body as the posterior superficial arcuate fibres; while those springing from the opposite nucleus pass forward in the interolivary layer (olivenzuischenschichl), and emerge on the inner side of and through the pyramid, as well as between the pyramid and the olive, and form the anterior superficial arcuate fibres. 5. Fibres from the lower olive of the opposite side.

The last set of fibres were demonstrated by Meynert; but they do not, as assumed by Meynert and Wernicke, form a continuation of the posterior columns to the cerebellum. They compose, with a tract of fibres previously shown by Bechterew, ascending in the tegmentum, a system which unites the cerebellum with the base of the cerebrum through the lower olive.

Neither the formatio reticularis nor the pyramid of the medulla oblongata has any relation to the restiform body; nor does the latter receive any fibres from the fifth and eighth nerves, as stated by Edinger. The auditory nerve is connected to the cerebellum by a special bundle which ascends in the inner part of the middle peduncle. The fifth nerve has no connection at all with the cerebellum.

Within the cerebellum, the restiform body is distributed in three distinct bundles, viz.: 1. Containing the fibres from the direct cerebellar tract of the cord, from the nucleus of the funiculus cunextus, and from the lateral nucleus passes to the cortex of the forepart of the upper worm; 2. Composed of the fibres from the nuclei of the funiculi graciles, to the middle portion of the

upper worm on the same side; and 3. Comprising the fibres from the opposite olive, to the gray substance of the corpus dentatum, and in part, perhaps, to the cortex of the hemisphere.—*Archiv für Anatomie*, February, 1887.

### The Morphology of the Sacral Plexus.

It is by no means an unfrequent occurrence for the two popliteal nerves to arise separately from the sacral plexus; and in that case the external (or peroneal) nerve generally pierces the pyriformis muscle, the lower portion of which, therefore, separates this from the more deeply placed internal nerve. But when, in the usual arrangement, these nerves are united for a certain portion of their extent in a great sciatic trunk, the latter can be easily divided into its two constituents by dissecting off the fibrous sheath, and the popliteal nerves can be followed upward to their distinct origins. By thus separating the nerves, A. M. Paterson is enabled to show that the construction of the sacral plexus agrees in principle with that of the brachial, and to throw light upon the morphology of the nerves of the limbs.

The nerves proceeding to the popliteal trunks are each divided into an anterior and a posterior branch. By the union of the posterior branches of the descending offset from the fourth lumbar, of the fifth lumbar, and of the first and second sacral nerves, the external popliteal is formed; and the anterior branches of the same nerves, together with an offset from the third sacral, constitute the roots of the internal popliteal. The gluteal nerves are offsets of the posterior divisions, or external popliteal roots, the superior arising from the fourth and fifth lumbar and the first sacral nerves, and the inferior from the first and second sacral nerves. The small sciatic arises from the back of the second and third, and the pudic from the second, third, and fourth sacral nerves. The branch to the obturator internus springs from the second and third sacral nerves, that to the quadratus from the beginning of the internal popliteal nerve, and the nerve of the pyriformis from the posterior branch of the second sacral. The branches to the hamstring muscles are given off from the internal popliteal nerve.

Like the popliteal nerves, the obturator is formed by anterior branches, and the anterior crural by posterior branches of the second, third, and fourth lumbar nerves.

There are thus two chief sets of nerves passing to the lower limb—one comprising the anterior crural, external popliteal and gluteal, springing from posterior branches, and distributed in the original extensor aspect; and the other, consisting of the obturator and internal popliteal, springing from anterior branches, and passing to the flexor aspect of the limb. From this it is inferred that in the primitive condition of the limbs the nerves passing into them are divided into dorsal and ventral branches, which supply the corresponding surfaces, and that indications of this arrangement are retained in the mode of origin of the nerves and their distribution to the structures of the limb.—*Journal of Anatomy*, April, 1887.

### On the Bursa Pharyngea.

The name bursa pharyngea was given by F. J. C. Mayer to a small pouch of the mucous membrane described by him, and afterward more fully by

Luschka, as projecting from the upper end of the posterior wall of the pharynx. According to Luschka, this pouch may attain a length of 15 mm. and a breadth of 6 mm.; it lies behind the adenoid tissue, constituting the pharyngeal tonsil; and its blind upper extremity is connected with the basilar process of the occipital bone. The normal existence of such a pouch has been denied by Ganghofner and Trautmann, who found only a small depression of the mucous membrane at the spot indicated; and for this, Ganghofner proposed the name of *recessus pharyngeus medius*. On the other hand, Tornwald states that a sac or canal is present in the great majority of cases.

In view of these conflicting statements, SCHWABACH examined this region in 53 subjects, 28 being infants or young children, in whom alone a normal pharyngeal tonsil is to be seen, and in no case did he find a bursa as described by Luschka, while Ganghofner's account is fully confirmed.

In the young subject the pharyngeal tonsil is divided by fissures into ridges of variable height, which are directed for the most part more or less obliquely. On most preparations two ridges close to the middle line are more prominent than the rest, and enclose a central furrow of corresponding depth. In some cases, however, there is a median ridge dividing this furrow. At the back of the median furrow or ridge there is generally a slight depression about the size of a pin's head, and in four instances it took the form of a recess 2 or 3·mm. deep. A small transverse fold of the mucous membrane sometimes divides this depression into anterior and posterior parts, or separates it from the groove. In several cases there was no trace at all of this hollow; and in no instance was it more than a superficial depression of the mucous membrane devoid of any connection with the bone.

In the adult there are usually but few indications of the original conformation of the tonsil, the median cleft and its bounding ridges being the parts most frequently retained; but even when all the ridges have disappeared, the furrow is still represented by a slight fossa or a canal bridged over by the mucous membrane. Such bridges of mucous membrane are of frequent occurrence on the pharyngeal tonsil, on the roof of the pharynx, and in the recess of Rosenmüller; and the cavities may also be completely enclosed by mucous membrane giving rise to cysts. The descriptions of the bursa given by Luschka and Tornwald are regarded as relating to pathological states.

It has been shown by Dursy and Froriep that the recessus pharyngeus medius is not connected with the formation of the hypophysis cerebri; and the latter writer considers it probable that it is related to the retropharyngeal chorda. On this point Schwabach promises a further communication dealing with researches now in progress.—*Archiv für microskop. Anat.*, Feb. 1887.

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### ON THE CLOSURE OF THE CARDIAC ORIFICE OF THE STOMACH.

It was observed by Braune that water injected in considerable quantity into the stomach through the œsophagus, with the body in a horizontal position, does not flow out again, although no ligature is applied. To explain this phenomenon, A. v. GUBAROFF, working in Braune's laboratory, investigated the mechanism by which the cardiac orifice is closed. In part the closure is to be explained by the action of the diaphragm, the fibres of which form a sphincter around the œsophageal opening; but it is mainly due to a valve-

like arrangement dependent on the relation of the ending of the œsophagus to the stomach.

In a frozen section, the stomach being distended, the lower end of the œsophagus is seen to be bent sharply to the left, the fundus of the stomach extends upward considerably beyond the cardia, and the left margin of the latter projects toward the right or lower border in the form of a rounded edge or fold containing a thick bundle of fibres of the diaphragm. When water is injected under a low pressure into the stomach from the duodeno-jejunal flexure, it does not flow into the œsophagus so long as the parts are in their natural position; but if the stomach is drawn downward, so as to stretch the angle between the œsophagus and the fundus, the fluid enters the gullet. In the child the œsophagus takes a straighter course to the stomach, and the facility with which food regurgitates in the infant is thus accounted for. Perhaps the varying readiness with which vomiting occurs in different people is to be attributed to the degree of development of this valvular structure.—*Archiv für Anatomie*, February, 1887.

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### On the Position of the Duodenum, of the Ileocolic Junction, and of the Sigmoid Flexure.

P. Schiefferdecker publishes observations on the variations in position of certain parts of the intestinal canal, collected during the dissection of about two hundred bodies in Rostock and Göttingen. In the duodenum the only noteworthy class of deviations relates to the length of the second part, and the consequent level at which the third part crosses the spine. This may be as high as the disk between the second and third lumbar, or as low as the top of the fifth lumbar vertebra. The situation of the duodeno-jejunal flexure is very constant.

The opening of the ileum into the large intestine is most frequently placed on a level with, and a little to the outer side of the right sacroiliac articulation. A lower position is often met with; and occasionally it lies in the cavity of the true pelvis. Only two cases were met with in which the ending of the ileum had a markedly higher position than usual; in one it was opposite the third lumbar vertebra; and in the other in front of the kidney, on a level with the second lumbar vertebra, so that there was practically no ascending colon. In both these instances the other abdominal organs were normal, and the testicles were in the scrotum.

The position of the sigmoid flexure is very variable, and the different forms are collected into four groups, as follows:

I. The flexure lies to the inner side of the descending colon.

*a.* The loop hangs down in the pelvic cavity. This is regarded as the normal form as shown by the developmental history, and by its being mechanically the most natural.

*b.* The loop is turned upward and applied to the posterior abdominal wall. In one extreme case the loop ascended on the side of the spine to the left kidney, being fixed here by the peritoneum; and in another the loop, having a free meso-sigmoideum, crossed the middle line and reached the right iliac fossa, where it touched the cæcum. Between these extremes all intermediate forms occur.

*c.* The loop is directed upward, but other parts of intestine intervene between it and the posterior wall; and it may come in contact to a greater or less extent with the anterior wall. These cases are very frequent.

II. The flexure lies to the outer side of the descending colon. Only one example of this condition was met with; and it is probable that it differs in kind from the foregoing groups, being not merely an irregular position of an identical loop, but a loop formed in the intestine immediately above the situation of the normal one which is undeveloped.—*Arch. für Anat.*, Feb. 1887.

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### On the Relative Length of the Fingers and Toes.

W. Braune contributes some interesting observations on the form of the hand and foot in a paper contained in the volume recently dedicated to C. Ludwig by his pupils. It is well known that in works of art the hand is generally represented with the index finger more prominent than the ring finger, whereas in nature such a form is only met with exceptionally. But the attempt to estimate the length of the several fingers by inspecting the hand, or even by tracing the outline on paper, after Ecker's method, is fallacious; and only direct measurements of the bones yield trustworthy results. Braune gives a table of the length of the metacarpal bones and phalanges in 93 hands, in 39 of which the bones were still united by their ligaments, while the remaining 54 were artificially mounted. In the following statistics the latter group is not taken into account, since there may be doubt as to the proper position of some of the bones.

Taking the metacarpal bones and phalanges together, the index finger is longer than the ring in 27, and shorter in 10, while the two are equal in 2. In all the second metacarpal bone is longer than the fourth, and the phalanges of the ring finger are longer than those of the index finger. The first phalanx of the index is the longer in 33, of the ring finger in 3, and the two are equal in 3. The middle phalanx of the ring finger is the longer in all. The last phalanx of the ring finger is the longer in 34, that of the index in 4, and in one case the two are equal.

The greater length of the index finger as a whole thus depends entirely (as was pointed out by J. Marshall, in his *Anatomy for Artists*, 1887) on the length of the metacarpal bone. The greater prominence of the ring finger usually seen in the hand is attributed by Braune to a lateral inclination of the fingers to the ulnar side, due primarily to the oblique pull of the flexor muscles. The hand with a longer index finger is the higher form, not simply by reason of contrast with the hand of the ape, but because it is thereby better fitted for the special work of man.

In the same way, the foot is generally represented by artists with the second toe projecting beyond the first, but in the natural foot the great toe almost always appears the most prominent. This appearance is, however, a result of the flexion of the second toe, caused by the pressure of the shoe; and if it be carefully straightened, the second toe is generally found to be the longest. Of 37 students of his class, Braune found the second toe longer in 26, the great toe longer in 6, and the two of equal length in 5. In children and people who go barefooted the second toe is the longest.

The characteristic forms of the hand, with its longest third digit, and of the

foot, with its longest second toe, are evident at a very early period in the fœtus. Whether there is any variation in the proportions referred to among different races of men, as assumed by Ecker, Kollmann, and Park Harrison, the material at present available is insufficient to show.

## PHYSIOLOGY.

UNDER THE CHARGE OF

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### Visual Centres of Cerebral Cortex.

Prof. Sigm. Exner and Dr. Joseph Paneth found defective vision, lasting some weeks after the operation, to follow removal of parts of the sigmoid gyrus of the dog. This was observed in five out of six animals. In that in which there was no defect of vision the lesion was just in front of Munk's centres. They therefore agree with those authors who deny that the visual functions are to be restricted to the posterior parts of the convexity of the brain.—*Pflüger's Archiv*, Bd. xl. p. 62.

### Irritability of the Various Layers of the Cerebral Cortex.

Drs. Ernst Asch and Alfred Neisser experimented on rabbits to determine whether gray surface tissue or the underlying white substance of the motor regions of the brain be the more easily excited by electric stimulation. They conclude that in the track from the surface to the deeper parts of the brain there exists a point the stimulation of which is followed by much more active movements than if any other part of the path of the impulse be similarly stimulated. This point is the boundary between the gray and white substance, and most probably it really is the innermost layer of the gray matter. With weak stimulations, the electrodes piercing the gray matter, the authors frequently found movement of the limbs on the same side of the body as the stimulus was applied to the brain.—*Pflüger's Archiv*, Bd. xl. p. 191.

### Intracardiac Pressure.

J. Magini estimates the variations in the blood-pressure within the heart of dogs by means of a special trocar pushed through the apex. The position and surroundings of the organ were but little disturbed by the operation, which was borne well by the animals, so that the investigation could be continued sometimes for an hour. Only twice in twenty-one operations did insurmountable complication arise. The trocar was connected with a manometer and cardiographic apparatus by means of a thick-walled caoutchouc tube filled with soda solution. The action of the valves thus escaped the interference with their function inseparable from Marey's mode of procedure.

The pressures were generally rather higher than those found by other observers, and the curves free from the secondary variations which are so marked on Marey's tracings. A negative pressure was found in the pericardium equal to thirty mm. of mercury.—*Arch. Ital. de Biologie*, t. viii. fasc. i. p. 125.

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### The Union of Carbonic Acid with Hæmoglobin.

By comparing the amount of $CO_2$ taken up by water—which follows Henry's law—with that taken up by solutions of hæmoglobin, Christian Bohr shows that considerable volumes of $CO_2$ may be made to unite with the coloring matter of the blood. One gramme of pure hæmoglobin combines with about 3.5 c. c. $CO_2$ at a pressure of 120 mm.—*i. e.*, more than double the quantity of oxygen that can be taken up. The combination is readily dissociated, for the quantity existing in the solution diminishes rapidly as the pressure is lowered. The maximum absorption is reached within the degree of pressure named above. Stronger solutions take up less per unit of hæmoglobin than weak solutions. No decomposition of the hæmoglobin occurred.—*Beiträge zur Physiologie, C. Ludwig gewidmet*, 1887, p. 164.

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### The Coagulation of the Blood.

L. C. Wooldridge obtains blood from a dog immediately after the injection of peptone, which does not undergo coagulation, though kept till it decomposes. In the clear plasma separated from this by means of the centrifugal machine, two complex bodies can be shown to exist, which are both coagulable, and by whose inter-action fibrin is produced. He names them A. and B. fibrinogen, and supposes them to be a mixture or combination of albumen with lecithin. The A. fibrinogen can be precipitated from the clear plasma by cooling. It appears as small, round, colorless masses which readily combine to form a fibrinous material. In the presence of this body the plasma is easily made to coagulate, the existence of fibrin ferment having apparently no influence. If the A. fibrinogen be removed, the B. fibrinogen will not coagulate without the addition of some substance containing lecithin. B. fibrinogen, therefore, cannot be the same body as Hammarsten's fibrinogen, since the addition of fibrin ferment does not induce its coagulation; but by repeated precipitation with acid and resolution in weak alkalies, it assumes the properties of that body. The clear plasma, freed from all form elements by the centrifugal machine, contains all the ingredients necessary for spontaneous coagulation. The ferment which appears during coagulation is said to be the result and not the cause of the clotting, which depends upon some transfer of lecithin taking place from one kind of fibrinogen to the other. Other kinds of fibrinogen are said to exist in the tissues of the body which can cause coagulation either within or without the bloodvessels.—*Beiträge zur Physiologie, C. Ludwig gewidmet*, 1887, p. 221.

# MATERIA MEDICA, THERAPEUTICS, AND PHARMACOLOGY.

UNDER THE CHARGE OF

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## Acetanilid (Antifebrin).

This promising contribution to our therapeutical resources has recently been the subject of an elaborate investigation by Weill (*Bull. Gén. de Thérap.*, Feb. 28, 1887). He arrives at the following conclusions in regard to its physiological actions: It acts especially on the nervous system, and after a period of excitation is followed by depression and collapse; it induces general anæsthesia and analgesia; it causes a notable increase in the intravascular blood-pressure by contracting the peripheral arterioles; it lowers the central and peripheric temperature, and in a toxic quantity seriously impairs the composition of the blood, changing hæmoglobin into methæmoglobin.

On the foregoing conclusions respecting the physiological actions of acetanilid, Weill bases the therapeutical applications. He has formulated the following opinions as to its therapeutical uses:

Acetanilid is an active febrifuge. It has the highest utility in almost all diseases of which the one symptom to be relieved is elevated temperature.

It acts efficiently in all nervous affections characterized by a morbid excitability of the reflex functions—as, for example, epilepsy.

It does not increase but rather diminishes the flow of urine.

Habit is set up by uninterrupted and prolonged administration.

Acetanilid, as antifebrin, has also been the subject of investigation by Prof. Lépine, who enlisted Prof. Charcot in its clinical study. As a remedy for the pains of locomotor ataxia, and for the trembling of sclerosis, it was found to relieve many, and to remove the symptoms entirely in a few. Having the power to diminish the reflex excitability of the spinal cord, it was also used in cases of epilepsy with considerable success.

Grunneberg (*Berl. klin. Wochenschrift*, p. 849, 1886) reports the result of his use of antifebrin in typhoid. He finds it very effective when a considerable reduction of temperature is to be made. Although it may cause profuse sweats and severe chills preceding the rise of temperature, the action, for the most part, is free from unpleasant symptoms. He has given 2 grammes (℥ss) a day without inconvenience, but 50 centigrammes (8 grains) have proved a sufficient quantity to reduce fever.

Dujardin-Beaumetz (*Bull. Gén. de Thérap.*, March 30, 1887) has also made a clinical investigation of acetanilid in continuation of the observations of Weill. As a febrifuge he does not regard it as an important contribution to our resources in this respect, and holds that it is much inferior to antipyrin for this purpose. It is in respect to its action on the nervous system that he commends its use. It is a remarkable fact that acetanilid does not influence temperature when administered in the apyretic stage, but during the height

of the febrile exacerbation, even in moderate doses, it makes a considerable impression on the pyrexia, reducing fever heat several degrees.

Dujardin-Beaumetz has never exceeded 3 grammes (46 grains), and usually gives no more than three or four doses of 50 centigrammes each (8 grains) in the course of twenty-four hours. He has employed it for the relief of three conditions, namely: for pain in general, for the pains of locomotor ataxia, and for epilepsy.

In facial neuralgia it is inferior to aconite, but when structural alterations are taking place in the nerve, as in neuritis of the optic, acetanilid is superior to all other remedies. In muscular rheumatism and neuralgia, and in neuralgia of the articulations, he has found it superior to the salicylates. Also, in the flying pains of tabes it seems to be peculiarly effective. Sometimes the effects are lasting, but in other cases the remedy loses its influence after long-continued use.

In epilepsy Dr. Dujardin-Beaumetz finds acetanilid a useful remedy. Recognizing the uncertainty which must attend the exhibition of a new remedy in this malady, so much influenced by mental impressions, a degree of reserve is necessary in accepting favorable conclusions. In his own hands and in the experiences of others, especially of Prof. Grasset, of Montpelier, some remarkable results have been obtained. With due reserve, and making allowances for error, there is yet sufficient evidence to show that acetanilid is a valuable addition to the remedies now employed in the treatment of epilepsy.

We add to the foregoing observations on acetanilid, or antifebrin, some studies of its therapeutical action made by H. EISENHART in Ziemssen's Clinic, which appear in the *Centralblatt für die gesammte Therapie* for April, 1887. Eisenhart reports on thirty cases of disease, including typhoid, acute rheumatism, pneumonia, some eruptive fevers, and other febrile disorders. The doses usually administered ranged from four to eight grains. The effects are observed in about two hours, and the reduction of temperature amounts to 1° to 4°, the maximum impression occurring in three to four hours. The normal temperature is little, if at all, affected by it, and hence, as has been observed by others, it should not be administered in the apyretic stage, but rather at the time of greatest heat. The duration of the antipyretic action ranges from four to fourteen hours. As is the case with antipyrin, antifebrin causes profuse sweating; but it is well borne, does not cause nausea or vomiting, and is readily taken.

In acute rheumatism, as compared with antipyrin, Dr. Eisenhart finds it inferior, and it is also less curative than the salicylates; but he admits that it is a valuable antipyretic in general, and especially in typhoid. He expresses the conviction that the course of typhoid is rendered milder and its duration lessened by the administration of antifebrin.

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### ANTISEPTIC HYPODERMATIC INJECTIONS.

So much has been published of late on this important subject that our readers may desire more exact information than has hitherto been furnished. The oil of vaseline which is used as the vehicle is obtained better from Russian petroleum. It is described by DR. LEY, who pursued his investigation in the laboratory of Dujardin-Beaumetz (*Bull. Gén. de Thérap.*, March 30,

1887), as a colorless, inodorous, tasteless, oily fluid, neutral in reaction, and of a density varying between 0.820 and 0.880. It causes no pain or induration when thrown under the skin. It dissolves the essential oils in equal parts, and such substances as iodine, bromine, sulphide of hydrogen, carbolic acid, iodoform, iodol, sulphide of carbon, and by some special manipulation, a large number of the alkaloids, as morphine and cocaine, in varying proportions. When thrown under the skin, oil of vaseline diffuses rapidly, and as quickly conveys the medicaments incorporated with it, through the system.

The clinical studies were made in the wards of Dujardin-Beaumetz in the Cochin Hospital, and the results derived from various agents used in this way are set forth in the communication from which we now quote. The solution of iodine gives some admirable results in cases of emphysema and asthma and bronchial catarrh; the cough diminishes, the expectoration lessens, the sense of oppression ceases, the appetite is restored, and sleep is again enjoyed. Solutions of carbolic acid and eucalyptol have been tried in a great many cases of chronic bronchitis and pulmonary tuberculosis. In some examples of the latter the injections caused too much excitement and fever to be persevered in; but in those of a chronic and subdued character, with little fever, eucalyptol had good effects, diminishing the cough and expectoration, modifying the sputa, lessening the sweats, and restoring sleep and appetite; but it was much less useful and sometimes injurious in more acute cases, more nearly approaching the type of phthisis florida.

The solutions of carbolic acid administered subcutaneously, and the same combined with iodine, produced surprising results. At the outset, however, the progress was slow, but the improvement continued, and even in unfavorable cases the results have been highly satisfactory—for not only in respect to the rational signs of phthisis has the most marked improvement taken place, but the *bacillus* is gradually made to disappear.

Dr. Ley concludes as follow: The pure mineral oil, now known as the *oil of medicinal vaseline*, is a very useful vehicle for making solutions to be employed subcutaneously. The oil of *arachides* (?) is, of all vegetable oils, the best adapted to the same purpose.

Of the medicaments subjected to experimental trials, iodine and carbolic acid occupied the first place, eucalyptol and sulphide of carbon coming after.

The injections containing eucalyptol had the strength of 20 to 50 per 100. The medium dose is 60 to 75 centigrammes (about 10 to 15 grains). After fifteen to twenty days use of the remedy, an intermission of a few days is desirable, or for the eucalyptol some corresponding remedy may be substituted, such as terpinol, terebinthin, etc.

Eucalyptol administered hypodermatically is quickly absorbed, and is eliminated largely by the lungs, but some accumulation takes place in the system, a fact that must be kept in mind. It does not affect the fever of pulmonary tuberculosis, but acts on the bronchial mucous membrane, and exerts a distinctly curative influence in the catarrhal affections of the bronchi. Its action is local, but it does not affect tubercle. Carbolic acid is a more efficient antiseptic, and when combined with iodine, has a very pronounced effect on bronchial catarrh.

In grave cases, better results are had from the administration of iodine and carbolic acid, the effects of which are uniform and persistent.

### Effects of Iodide of Potassium on the Assimilation of Nitrogenous Materials.

Contradictory opinions have been expressed as to the action of iodide of potassium on the assimilation and metabolism of nitrogenous matters. Bock long ago (1869) maintained that it has no effect of this kind, but subsequently Smirnow demonstrated that it does promote the disassimilation of nitrogenous substances. Recently Samoïlow has examined the question anew (*Thesis of St. Petersburg*, 1886) by a series of laboratory experiments, dogs being used for the purpose, and he concludes that small doses of potassium iodide promote the function of assimilation, but large doses act in the opposite manner, increasing the destructive metamorphosis of the nitrogenous tissues or materials. No doubt the waste caused by this agent may be in part due to its action on the mucous membrane—to the swelling and desquamation of the epithelium and thrombosis of the smaller vessels of the kidneys—hence Samoïlow holds that the large doses of iodide of potassium recommended by Keyes are dangerous.

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### Effects of Alcohol on the Digestive Functions in the Normal and in the Pathological States.

Dr. A. Gluzinski has examined anew this much debated question (*Deut. Archiv f. klin. Medicin*, vol. 39, 1886). His conclusions are as follows:

Alcohol disappears rapidly from the stomach. Two phases of the effects on digestion are to be noted: in the first, there is a marked diminution in the power to digest albuminous substances; the second phase commences after the elimination of the alcohol, and during this period the functional activity of the stomach is such that digestion is completed somewhat earlier than in the normal state. Alcohol in the first phase, inhibits the activity of pepsin, but, on the other hand, stimulates the gland elements, in consequence of which during the second phase there is a more abundant production of hydrochloric acid. Dr. Gluzinski finds, therefore, that a small amount of alcohol exerts a favorable influence on the digestion of healthy persons.

In diseased states, after the absorption of a certain amount of alcohol, the two phases of digestion are much less pronounced, and hence the use of alcoholic drinks is not to be recommended in such morbid conditions of the digestive apparatus as dyspepsia.

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### Pilocarpine in Catarrh of the Tympanum.

Kosengarten has recently reported the good effects obtained by him in catarrh of the middle ear, by subcutaneous injections of pilocarpine (*Zeitschrift für Ohrenheilkunde*, 1886, vol. xiv., quoted in *Bull. Gén. de Thérap.*, April 15, 1887).

Politzer was the first to call attention to the use of pilocarpine in recent affections of the labyrinth, and these observations were confirmed subsequently by Moos and Wolff, and still more recently by Jacobson. Kosengarten conceived the notion of making pilocarpine injections in chronic troubles of the middle ear, and they have proved to be highly useful.

### The Hypodermatic Injection of the Insoluble Salts of Mercury.

The treatment of syphilis by the subcutaneous injection of mercurial salts yet remains an undecided question. In an elaborate historical and critical review of the subject, Dr. Guelpa seeks to establish some principles for more accurate guidance (*Bul. Gén. de Thérap.*, April 15, 1887).

The method of Scarenzio, set forth in his great work, has been the point of departure in recent times in the therapeutical applications of mercury subcutaneously. Calomel and the yellow oxide are the mercurial salts employed by him, and his conclusion was that the hypodermatic method is superior to friction or fumigation. The next most important contributions to the subject were made by Smirnoff, who occupied himself with determining the best site for the injections, as well as the general principles applicable. Smirnoff advises that the depression in the hip behind the great trochanter be selected for the operation, because here the areolar tissue is abundant, loose, and extensible. Suitable care taken, abscesses do not form, and the pain and discomfort are reduced to the minimum. If mercurialism occur, Smirnoff holds that it is due to impure air, and the mercurial vapor generated in an apartment occupied by many subjects undergoing the mercurial treatment. It follows that careful attention to ventilation and to the supply of pure air becomes necessary to success.

Smirnoff concludes that the hypodermatic method is required where prompt results are necessary; that it is contraindicated when mercurial periostitis has appeared; that it is the most convenient and simple of the methods used; that it is applicable to all ages and stages of the disease; that it is superior in efficacy to the treatment by inunction, and more active than any other mercurial plan.

Dr. Guelpa, in concluding his memoir, states that he has not yet attained to a final conviction on the subject, but he expresses the opinion based on an unprejudiced examination of the question, that the hypodermatic injection of the salts—especially, perhaps, of the insoluble salts of mercury—must be regarded as a method of treating syphilis of general utility, and in a special case incontestably superior to all other plans.

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### The Preventive Treatment of Syphilis.

Prof. Neumann has recently published the results of his clinical work in this department (abstracted in the *Bull. Gén. de Thérap.*, Feb. 15, 1887). The so-called "preventive treatment" consists in excision of the induration and mercurial inunctions. Neumann finds that extirpation of the local disease does not prevent general infection, nor does the mercurial inunction prove more efficient in this respect.

The expectant treatment is rejected by him because of the great length of time required, because such subjects continue to be a source of infection, and because the ulterior accidents are often very serious in character.

Finger, of Vienna, although regarding excision as possibly successful, thinks it hazardous on the whole. He is opposed to the preventive method and expectancy, and still maintains the superiority of iodine and mercury in the treatment of all the manifestations of syphilis.

### Treatment of Neuralgia of the Fifth Nerve.

Prof. Gussenbauer (*Prag. med. Wochenschrift*, No. 31, 1886, quoted) remarks that trigeminal neuralgia is very frequently a reflex action proceeding from the intestines in the course of an obstinate constipation. In 33 cases under his observation there were but 3 requiring surgical interference, and in the others cures were obtained by methodical treatment of the constipation. In most of the cases sensible amelioration occurred in about fifteen days of the treatment. The measures employed consisted in cold enemata, fomentations, and cold frictions of the abdomen.

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### Cocaine in Cardiac Asthenia.

Noorden (*Berliner klin. Wochenschrift*, No. 51, 1886) has had good results (*véritablement merveilleux*) in pseudo-angina pectoris by the use of cocaine. He offers no explanation of its utility, but compares its action in these cases to that obtained by Bescharner in bronchial asthma.

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### The Formiates and their Disposal in the Organism.

MM. Gréhaut and Quinquad publish in the *Archives de Physiologie*, April 1, 1886, an elaborate research on the disposition made of the formiates when introduced into the body. (*Recherches sur les Formiates Introduits dans l'Organisme.*) It will suffice to give their conclusions. Although not a matter of immediate practical importance, the facts may serve to explain, or suggest by analogy, how similar substances act under corresponding conditions.

MM. Gréhaut and Quinquad conclude that when formiate of soda is introduced into the digestive canal or thrown into the blood, it is eliminated by the kidneys without undergoing decomposition, and that the urine contains no more than the usual proportion of carbonates.

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### Hot Water in Acute Prostatitis.

Dr. Cazeaux (*Thèse de Paris*, 1886) finds that hot water enemata and applications to the perineum are very effective at the onset of prostatitis and before the occurrence of suppuration. He advises water at the temperature of 130° F., to be used by the irrigator three times a day to the perineum and in the rectum.

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### Massage in Sciatica.

Prof. Max Müller advocates the methodical use of massage in sciatica. (*Deut. medinis. Wochenschrift*, No. 24, 1886.) Of a group of fifteen patients of varying ages, he succeeded admirably in all by this treatment. All of them were severe cases, having intense pain and considerable disorder of motility. Massage was applied in the ordinary way, the patient lying on the healthy side. The first *séances* were painful, but the irritability of the nerves rapidly subsided, and after a few treatments no pain was caused by it and permanent relief was obtained.

### Sparteine.

This new cardiac remedy, so much praised by Prof. Germain Sée, has been studied by Dr. Stoessel, of Vienna, and his observations appear in the *Centralblatt für die gesammte Therapie* of April, 1887.

After a statement of the opinions given by Sée, Dr. Stoessel narrates his own experiences. In respect to the value of sparteine in the condition of arhythmia of the heart, due to weakness of the heart-muscle, he does not agree with Prof. Sée, who maintains that it is superior to digitalis here. Especially does Dr. Stoessel find sparteine inferior to digitalis in the irregular rhythm and weakness due to fatty degeneration of the heart.

Another fact, showing the superiority of digitalis, is that this remedy is an efficient diuretic, while sparteine has little or no action on the kidneys.

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### Salol.

In the *Therapeut. Monatsh.*, p. 47, 1887, Bielchowski publishes the results of his experience with salol in acute rheumatism. In the quantity of 5 grammes a day (75 grains) it acts promptly in arresting the disease, and, when a relapse occurs, a single dose will usually prove immediately successful.

Rosenberg has also employed it with complete success. Its advantages are, that it does not disturb the digestive organs, and is not difficult to administer; but the chief point is, the curative power, which is so much greater than the salicylates have, but there is no evidence to show that it succeeds better than other agents in preventing the cardiac complications.

We submit some further observations on salol, that our readers may have the data for forming correct conclusions. A full abstract from a paper by Dr. Fr. Eduard Georgi, is published in the *Centralblatt für die Therapie* for April, 1887, from which we obtain the facts here given.

As regards the topical use of salol, Dr. Georgi did not find it superior to the remedies now employed for the relief of nasal and pharyngeal diseases. By the stomach it may be given in doses of 10 to 30 grains without inconvenience. In a case of febrile icterus it had a rapid effect, both in reducing the fever and clearing up the jaundice. It proved to be effective in lessening the temperature of the phthisical also.

In pyonephritis, cystitis, etc., it was found to be very active in checking suppuration, and preventing and removing the products of decomposition of the urine.

In acute rheumatism Georgi ascertained it to be exceedingly valuable, one or two doses often relieving the pain entirely, and in all cases relief was obtained in two or three days. Two grammes (30 grains), in the twenty-four hours, were found to be sufficient, and it was rarely necessary to administer more than ten to twelve grammes (150 to 180 grains), in all, to effect the removal of the rheumatic pains. When this was accomplished, the dose was reduced to 15 grains a day until complete recovery. Relapses were not frequent. The largest dose given caused no unpleasant sensations, and only in three out of twenty cases was buzzing in the ears brought on. Weakness of the heart, small pulse, or indications of collapse, never occurred. As an antipyretic in febrile disease salol proved to be certain in its action and

powerful, but massive doses are necessary—from 30 to 60 grains. Unlike the other antipyretics of this group, salol induced but moderate perspiration.

### Iodol and Iodoform.

Schnirer makes (*Semaine Médicale*, 1886, p. 406, quoted by *Bull. Gén. de Thérap.*, February 15, 1887) some observations on the comparative utility of iodoform and iodol.

As the odor of iodoform is so strong, diffusive, and penetrating, iodol is a happy substitute, since it has but little taste or odor. It is a brown powder, which may be used topically, or taken internally, in the quantity of 25 to 50 centigrammes (4 to 8 grains). Experience has confirmed the original statements as to its utility. It is equally effective with iodoform, and can be substituted for the latter in the whole range of the topical uses, and probably, also, for internal administration.

### Chlorhydrate of Péreirine.

In a recent communication (*Bull. Gén. de Thérap.*, April 15, 1887) Dr. Ferreira, of Brazil, calls attention to the power of *chlorhydrate of péreirine* in the cure of malarial infection. This alkaloid is obtained from a member of the Apocynaceæ, which grows spontaneously and in great abundance in Brazil. The dose prescribed by Dr. Ferreira is two grammes (about ʒss), in two parts, at a half-hour interval. He finds it an efficient antiperiodic, less irritating to the stomach than quinine, and sometimes successful when quinine has entirely failed. It appears to be more useful in the acute cases.

## MEDICINE.

UNDER THE CHARGE OF

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### On some Cases of Infectious Cerebro-spinal Meningitis, with Remarks on the Diagnosis of the Disease.

Senator (*Charité Annalen*, xi. 248, 1886) reports eight cases of this affection, and emphasizes the difficulty attending its diagnosis. The disease can be most easily confounded with typhoid fever, tetanus, and with other forms of meningitis cerebro-spinalis. But even in cases of cerebral hemorrhage into the meninges or ventricles, where decided stiffness of the neck is com-

bined with spasm and contractures of the extremities, a confusion with cerebro-spinal meningitis may arise, especially as absence of the tendon reflexes is observed in severe cases of the latter affection.

Acute rheumatic arthritis of the articulations of the vertebral column, narcotic poisons and those producing spasm, uræmia, diabetic coma and the nearly allied coma of other dyscrasic conditions, are also to be borne in mind in forming a diagnosis. The previous history of the disease in each case is of the greatest importance, since in other disorders the symptoms usually do not occur in the same order as in cerebro-spinal meningitis. At the height of the disease there are to be observed a stiffness of the neck, various eruptions of the skin—especially herpes, fever, and sweats which are not critical. The swellings of the joints, which develop later in the disease, are of diagnostic import. In one case it was observed that the diazo reaction was absent. This feature, if confirmed, would be of importance as distinguishing the disease from typhoid.

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### Mountain Fever.

In a "Report on the Topography, Botany, Climatology, and Diseases of Surprise and Goose Lake Valleys, California," by Kober, we find a short notice of mountain fever. He says that it differs essentially from the clinical pictures of enteric and remittent fevers, and represents, he believes, a union of the typhoid and malarial poisons. The disease is ushered in by a chill or chilly sensation, repeated during two or three days. There is some aching of the head and of nearly every part of the body. The tongue is covered with a thick yellowish or bluish fur, but with the borders and tip clean and red. Often there is slight pharyngeal and nasal catarrh. The temperature reaches 101°–104° F., and in the first stage of the disease especially exhibits marked exacerbations and remissions, suggestive of quotidian and remittent fevers. The pulse is 90–110 and full; epistaxis and abdominal symptoms are rare in the early stages; there is no eruption; herpes is common; sweating more common than in typhoid. The fever continues four or five weeks, and in the graver forms abdominal and adynamic symptoms develop. Early treatment usually cuts the disease short; but if neglected, it runs into the typhoid stage and quinine has no curative influence. He has often seen the disease attack men who have lived in places where it seems impossible that the typhoid germ could have existed. He thinks it likely that this was obtained from the pollution of some of the mountain streams by beaver dams and large game. The author agrees with Hoff (Amer. Journ. Med. Sci., for January, 1880), who, following Woodward, calls the affection typho-malarial fever, and believes that it is a hybrid disease—*i. e.*, typhoid, modified by intermittent. He says that it begins as an intermittent, and that this stage is followed in two weeks by the typhoid stage, which lasts about four weeks, and exhibits the typical typhoid symptoms. A postscript by Woodward confirms him in the statement that necropsies almost always reveal the lesions of typhoid.

This would seem to be conclusive, but it is but right to say that opinions are somewhat divided. Smart (Amer. Journ. Med. Sci., 34, 1878) claims that mountain fever is only a malarial remittent with adynamic tendencies. Hirsch (*Handb. of Geog. and Hist. Path.*, Eng. transl., 1883) refers to it as a

variety of malaria. There is also some unfortunate confusion in the name employed. SQUIRE, in the last number of this journal, describes typho-malarial fever as malarial fever which has assumed the adynamic type present in typhoid fever, and applies the name "malarial enteric" to those cases in which there is a union of both diseases, as seems to be the case in mountain fever.

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### THE MICROÖRGANISMS IN THE VARICELLA VESICLE.

GUTTMANN (*Virchow's Archiv*, B. cvii. H. 2, 259) has investigated the contents of the vesicles in three cases of varicella, with regard to the presence of bacteria. In cultures made upon agar-agar, he discovered three varieties of cocci: 1st, the Staphylococcus aureus; 2d, one which he names Staphylococcus viridis flavescens, which is characterized upon the culture medium by a color at first resembling that of an unripe lemon, and later becoming more yellow. It is never white; 3d, a coccus exhibiting on agar-agar culture a white color.

Inoculations of these cultures upon animals were without result, except in the case of the Staph. aureus, which proved fatal in one instance. Guttmann believes that cocci of various other species may occur in the varicella vesicles, and refers to a species previously reported by Bareggi.

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### PERIPHERAL NEURITIS.

In discussing this subject in the *Brit. Med. Journal*, 1887, p. 6, ROSS says that the symmetrical manner in which the disease usually attacks the body shows that at least in the majority of cases it is produced by some poison in the blood. Thus salts of lead, arsenic, and probably of copper and other metals are capable of giving rise to it. In a second group of cases the disease is caused by alcoholic excess, the fumes of bisulphide and oxide of carbon, and probably by the abuse of chloral and chloroform. It has also been observed in advanced diabetes. A third variety arises from animal poison. Diphtheritic paralysis is the best known instance of this. It is also to be observed in syphilis, smallpox, scarlet fever, measles, typhoid, typhus, intermittent fever, dengue, tuberculosis, leprosy, and beri-beri. It is probable that it may be caused by rheumatism, and that the wasting of the extensors seen in chronic rheumatoid arthritis is due to a neuritis of the neighboring nerves. There is also an *idiopathic* multiple neuritis.

The symptoms consist in more or less widely distributed atrophic paralysis. Ross has never been able to assure himself that active spasm preceded the paralysis in any case. The condition of the cutaneous reflexes varies. With a very few exceptions, the patellar reflex has been wanting in all recently reported cases of alcoholic, diphtheritic, and other forms of neuritis of the lower extremities. The knee-jerk is sometimes absent in lead poisoning, even when the muscles of the lower extremities are not appreciably involved. Yet the failure of the patellar reflex is a valuable but not an absolute sign of neuritis. The electrical test affords conclusive evidence in the majority of cases. The faradic excitability of the affected nerves and muscles is lessened or abolished, and the reaction of degeneration is detected with the galvanic current. The paralysis affects especially the extensors, as is well seen in the "wrist-drop" of lead palsy. That following alcohol, bisulphide of carbon, the animal poisons, and even arsenic, usually attacks the extensors of the lower extremi-

ties first. Paralysis of the extensors of the forearm soon follows in alcoholic neuritis, then the thighs and upper arm, then the flexors of the leg and forearm, and finally even the muscles of the trunk may become involved.

In diphtheritic paralysis the soft palate is the first to be affected; then the muscles of the eye, and after some time the lower extremities. The arms are seldom involved.

The paralysis of the extensors in neuritis produces a temporary or permanent flexion of the limb, simulating a spasm of the flexors.

The sensory disturbances accompanying the paralysis resemble considerably those of locomotor ataxia.

The disease may most easily be confounded with chronic poliomyelitis, Landry's paralysis, and locomotor ataxia. From the first it is distinguished by the presence of well-marked sensory phenomena, and by the order in which the muscles are attacked. From the second it differs in exhibiting the reaction of degeneration with marked sensory disturbances and wasting of the muscles. From the third it differs in many respects, but the character of the gait is sufficient to distinguish it. We observe, namely, in neuritis a peculiar elevation of the knee in walking, with a drooping of the toes, and an unusual exposure of the sole of the foot to one standing behind the patient. Such a case is unable to elevate the toes if sitting on a chair with the soles flat on the floor.

As regards the pathological anatomy of the disease, the author shows that opinions are now generally agreed that the lesion is seated in the nerves themselves and not in the cord.

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### On Pseudo-Tabes from Arsenical Poisoning.

Dana (*Brain*, xxxvi. 456, 1887) reports two cases and makes a careful study of the literature of arsenical paralysis, appending over 100 references. He concludes that there are two forms of this, just as there are of diphtheritic and alcoholic paralysis.

1. The ordinary arsenical paralysis, in which the motor affection and the atrophy are more marked than the sensory derangement.

2. Arsenical pseudo-tabes, in which there is no pronounced motor paralysis, but decided sensory disturbance, especially ataxia.

It is entirely improbable that either of these forms is due, as a rule, to a diffuse myelitis, but rather to a multiple neuritis; just as is the case in paralysis from lead, alcohol, diphtheria, and probably from other infections and poisons.

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### On the Early Recognition of General Paralysis of the Insane; and the Relation between this Disease, Tabes Dorsalis, and Disseminated Sclerosis.

J. Syer Bristowe, in an address reported in the *British Medical Journal* for 1887, p. 1, states that, although typical cases of general paralysis are easily diagnosticated, yet, in many instances, especially in the early stage, at a time when a diagnosis is so much to be desired, the recognition of the nature of the disorder is difficult, if not impossible.

He gives a synopsis of the symptoms, mentioning the fact that epileptiform attacks and other mental derangements may occur in all these disorders. In

general paralysis of the insane the paralytic symptoms are most pronounced in connection with the organs of speech. The usual duration of the disease is said to be two or three years, but it is probable that early indications, consisting of slight degrees of some of the characteristic phenomena, may be detected by the careful observer years before the first outspoken symptoms become noticeable.

Bristowe reports a series of interesting cases of general paralysis, illustrating the occasional difficulty of diagnosis. In one patient, for example, with fairly characteristic signs of general paralysis were associated symptoms both of tabes and of disseminated sclerosis. In this and in several other cases delusions never occurred. He then describes three cases, probably of locomotor ataxia, in which, however, there was so much mental disturbance that the diagnosis might be open to question.

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### Sudden Death in Pleurisy.

Weill (*Rev. de Méd.*, 1887, 33–64) reports a case of sudden death in pleurisy, and gives the notes of twenty-six others gathered from the literature, and which seem to him to fill the conditions of an *exitus* truly sudden. He excludes all cases of death from increasing asphyxia lasting some hours; and omits, too, all those in which thoracentesis had been performed, and death followed immediately or more remotely. His conclusions are as follows:

1. Sudden death in pleurisy appears to be associated with certain lesions, of which the principal are—thrombosis or embolism of the heart and of the pulmonary artery; sudden œdema of the lung on the side non-affected with pleurisy; alterations of the myocardium. These last often escape notice at the autopsy, since they demand the aid of the microscope for their detection. In some cases no cause at all can be found.

2. Cases of death attributed to simple functional trouble, such as severe syncope; or to mechanical interference, as displacement of the heart, torsion of the vessels, the bending of the ascending vena cava at a right angle; or to hypothetical lesions, as capillary embolism of the brain; ought to be admitted with great reserve.

3. Sudden death may occur in the most diverse varieties of pleurisy. The affection may be on either side (oftener the right); acute or chronic; with the effusion increasing, stationary, or decreasing. The liquid is usually serous.

4. Pleurisy ending in sudden death may or may not be accompanied by peculiar symptoms. There may be increase of dyspnœa, premonitory syncope, and irregular pulse. Very often death occurs when the case appears to be making most satisfactory progress. It is usually produced by some sudden effort.

5. Treatment is, of course, useless, when we have to do, for example, with lesions of the myocardium. The prophylactic treatment in other cases is thoracentesis. It is indicated either in the acute or chronic stage if threatening symptoms be present, or if there be increase of the intra-pleural pressure.

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### On Cases of Valvular Disease of the Heart, Existing for over Five Years without Serious Symptoms.

Sir Andrew Clark (*Brit. Med. Journ.*, 260, 325, 370, 1887) extracts from the clinical histories of his office patients since 1873, 684 cases in which there

existed well-marked chronic valvular disease of the heart, not indicated by any symptom, and not interfering with the patient's health. A series of elaborate tables accompanies the text. Concerning the diseases for which the patients were receiving treatment, it appears that nearly one-half were affections of the digestive system, and about one-fifth diseases of the nervous system.

The author relates, by way of illustration, a number of very interesting and instructive cases, not included in the tables, showing that the evidences of the gravest cardiac lesions could coexist with excellent health.

Many of the patients had been told by physicians previously in attendance that they could live but a short time. To others the strictest rules of diet and of exercise had been given, with the result that both health and happiness suffered greatly. For all of these cases, Clark recommended a return to the ordinary hygienic *régime* necessary for the physiological conditions of life. He warns us, however, that this is only suitable to chronic and stationary cases. When the heart is irritable, irregular, or frequent; when the murmurs vary in character and intensity, or when there is any febrile action, patients must be kept at rest, and the lightest diet administered. Any other course is most unsafe.

The author next reports several cases showing that well-established cardiac lesions having lasted several years, and due to inflammation of the valves, may in later years entirely disappear. This may be observed in the case of the mitral bruit often heard in chorea, and dependent on organic changes. These murmurs of chorea, in fact, usually disappear eight or nine years after the attack. The same disappearance of all evidence of disease can often be observed years after a rheumatic endocarditis had produced a loud systolic murmur. Although such recoveries are often seen in the young, yet they sometimes take place in the old, and the author quotes cases in substantiation of this fact. Even well-marked valvular defects of a degenerative nature may in rare cases disappear. There must be *differentiæ* between the histories, habits, surroundings, occupations, etc., of those who suffer and die of heart disease, and of those who are not in the least incommoded by its presence.

According to Clark, the factors necessary in mitral disease for the exemption from unpleasant cardiac symptoms, and for the continuance in the duties and enjoyments of life, are as follows: 1, good general health; 2, just habits of living; 3, no exceptional liability to rheumatic or catarrhal affections; 4, origin of the valvular lesion independently of degeneration; 5, existence of the valvular lesion without change for over three years; 6, sound ventricles with moderate frequency and general regularity of action; 7, sound arteries, with a normal amount of blood and tension in the smaller vessels; 8, free course of blood through the cervical veins; 9, freedom from pulmonary, hepatic, and renal congestion. The prognosis in aortic disease is not so favorable even under the same conditions.

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### On the General Pathology of Heart Diseases.

We make the following extracts from the posthumous paper of Schott on this subject (*Zeitsch. f. klin Med.*, B. xii. H. 4, 295):

*Insufficiency of the heart muscle.* This may be *absolute* or *relative*. In *absolute* insufficiency there is no obstruction to the circulation, but an absolute

diminution of muscle power. The heart muscle, like other muscles, is subject to atrophic changes from improper nutrition, lack of bodily and mental exercise, accumulation of fat, etc. "Fatty heart" can be cured without any loss of weight; but the usual treatment of obesity may act very injuriously on the heart by affecting the general nutrition. In very fat persons of great bodily and mental energy the heart retains its strength, as do other muscles. In purely *relative* insufficiency there is some obstruction to the circulation, but the heart muscle preserves its normal power. In reality, however, relative insufficiency is almost always combined with some loss of muscular strength. Complete compensation may exist or become developed.

*Dilatation.* Of this he makes two classes:

1. Dilatation which necessarily accompanies certain valvular lesions This, with muscular hypertrophy, forms an essential factor of the compensation. It may be called "compensatory dilatation." It is exemplified in the left ventricle in aortic and mitral disease.

2. The second form is characteristic of diseases of the muscle substance and of insufficient compensation. It is only the expression of an engorgement of the heart with blood, and might be named "dilatation of engorgement." It is very well represented by dilatation of the right heart following valvular disease of the left side, and by that of the left heart due to renal disease. It is produced by an imperfect emptying of the ventricle during systole. Dilatations of this form disappear with the development of complete compensation. After a few minutes of proper gymnastic exercise, the percussion boundaries of the heart sometimes become lessened. On the other hand, various causes may visibly increase the dilatation, as shown by the cardiac dulness.

*The cardiac murmurs.* In numbers of cases murmurs which were judged to be organic disappeared after a time. This is a strong proof that there had been no anatomical lesion. The sudden appearance and disappearance of murmurs may very often be observed. A murmur may sometimes be made to vanish in a few minutes through the diminution of dilatation produced by light gymnastics. The transition from mitral murmur to a divided (gespaltene) tone, which is often detected, is a probable proof of an abnormal action of the papillary muscle and of the absence of a valvular lesion. The author admits, however, that a recent mitral insufficiency due to endocarditis may, in rare cases, really heal. There exists an aortic insufficiency from dilatation of the aorta through high arterial tension. This murmur may disappear; but the author doubts whether true aortic insufficiency ever is curable.

*Peripheral passive congestion and hydrops.* Diminution of the amount of urine is a necessary result of heart disease, but need not be attended by dropsy. But when, through thirst, an increased quantity of fluid is brought into the system, hydrops appears. This increased thirst is induced by the retention in the blood of the solid elements of the urine. In other instances growing weakness of the right ventricle produces a like result. In all cases the progress of the circulatory disturbance is aided by the passive hyperæmia of the kidneys; and although the heart may grow stronger through treatment, the kidneys remain affected, and we find a clinical picture closely resembling that of contracted kidney. Great and painful increase in the size of the liver due to engorgement occurs early, even before any œdema or albuminuria appears;

but may be strikingly diminished by suitable gymnastics. The congestion of the lungs, liver, stomach, etc., is often much relieved by the development of œdema of the subcutaneous connective tissue. When the condition of engorgement becomes extreme, an element of inflammation is added. The pulmonary hyperæmia becomes splenization, the hydrothorax exhibits friction sounds, and erysipelas is very apt to appear.

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### New Investigations on the Gallop Rhythm.

Cuffer and Barbillion publish a long article in the February and March numbers of the *Archives Générales de Médecine*, 1887, in which they describe the gallop rhythm as made up of two normal heart sounds, to which is added a third abnormal one separated from them by an interval longer than in the case of a simple reduplicated beat. They draw the following conclusions:

1. A more complete classification of the varieties of gallop rhythm can be made than that at present adopted.

2. Gallop rhythms are *diastolic* or *mesosystolic*, according to the place which the abnormal bruit occupies in the cardiac cycle. In the first it immediately precedes, and in the second it immediately follows the cardiac impulse.

3. The diastolic gallop may itself be subdivided, according to whether it is produced in the *left* or the *right* heart.

4. The left diastolic gallop may be *permanent* or *transitory;* having in each case a different pathogenesis.

5. The permanent left diastolic gallop is due to a hypertrophy of the left ventricle, itself a result of a reflex influence from disease of the kidney; or of a permanent increase of arterial tension caused by a chronic nephritis or general arterio-sclerosis.

6. The additional beat is presystolic. It is a bruit of diastolic tension, caused by the blood forcibly entering, during systole, a rigid and unyielding left ventricle.

7. If the superadded sound is heard very close before the first normal sound, it is an evidence of concentric hypertrophy without dilatation. When it is separated by a longer interval, and tends to approach the second sound of the preceding cycle, it is an indication of dilatation, and the prognosis is more unfavorable.

8. Transitory left diastolic gallop is observed in acute affections of the kidneys, or in exacerbations of chronic affections. There is a spasmodic state of the cardio-arterial system, with a resulting transitory high tension.

9. Right diastolic gallop is produced by a reflex action from some gastric, hepatic, or intestinal disorder, exciting a spasm of the arterioles of the lungs, with an increased tension in the right heart. This increased tension causes the abnormal bruit in a manner analogous to its production in the left heart.

10. The mesosystolic gallop rhythm is characterized by an additional sound occupying the shorter silence.

11. There exist all grades of this, between the simple prolongation of the first sound and the most clearly marked reduplication.

12. It is the index of insufficiency of the cardiac systole which is sometimes slow and languid, sometimes acting twice to enable the ventricle to expel the blood which it contains.

13. The writers have met this variety of gallop rhythm in several cases of typhoid fever, in one of tuberculosis, and in one of mechanical interference with the heart. It might be met with wherever the heart is failing from any cause.

Finally, they reiterate that the diastolic gallop is a bruit of cardiac *strength* with *high* arterial tension, and the mesosystolic an *asthenic* bruit with *feeble* tension.

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### Morphine in Diabetes.

T. Mitchell Bruce (*Practitioner*, 1887, 20) was induced by his success with morphia in the treatment of a series of cases of diabetes, to study from a therapeutic standpoint some of the still unsolved questions concerning the pathology of the disease. By administering morphia *per orem* to a selected case, and thus reaching the liver through the portal circulation, the glycosuria was made to disappear. When as large doses of the drug as the patient could bear were given hypodermatically, almost no effect on the elimination of sugar was obtained. The author concludes that, in the case in question,

1st. The glycosuria was due to an increased ingress of sugar into the blood; not to a diminished destruction of it in the system, else the hypodermatic use of morphia would not have been without effect.

2d. The increased ingress of sugar was not caused by a simple transportation of sugar from the intestine or portal vein to the general circulation, inasmuch as it continued unabated when an exclusively animal diet was employed.

3d. The excessive glycosuria going on in this case was effected mainly, or entirely, in the liver; not in the muscles or the other viscera. For (*a*) when the morphia was introduced into the liver by the portal vein it reduced the sugar to *nil*, but had little effect on the other viscera, while (*b*) when introduced into the general circulation hypodermatically, it diminished the amount of sugar but little, but had a decided effect on the other viscera, especially the central nervous system.

4th. In this instance if the diabetes was of nervous origin, the seat of the process appears to have been at any rate in the liver, not in the central nervous system.

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### The Occurrence of Albuminuria in Diabetes.

Incited by the statement of Stokvis, that albuminuria is a very common complication of diabetes, Pollatschek (*Zeitsch. f. klin. Med.*, B. xii. H. 1, 379) undertook some investigations on the subject. He found that of 2877 persons whose urine was examined in one of the chemical laboratories in Carlsbad, 1187 had glycosuria, and 437 of these latter had albuminuria also. Or, in other words, 37 per cent. of the cases of diabetes had albumen in the urine. He found, too, that albumen occurred oftener in urine that contained over 0.5 per cent. of sugar.

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### On the "Starch-converting" Ferment in Human Urine.

Breusing publishes in *Virchow's Archiv*, B. cvii. H. 1, 186, his experiments relating to the statement of Holovtschiner made in April, 1886, that there existed in urine a ferment capable of transforming starch into dextrine and sugar.

He mixed equal portions of urine and of a one per cent. starch solution, and subjected them to a temperature of 37.5° C. for twenty-four hours or less. Although he found at the end of this time that the starch had completely disappeared, he was in no instance able to detect sugar by any test employed.

In Trommer's test the suboxide of copper was, it is true, precipitated *after* boiling for some time, but the author properly considers this no proof of the presence of glucose. Although the experiment was modified in various ways, and the urine, both of healthy persons and of those suffering from various diseases, was utilized, the result was always the same.

It was interesting to observe that the starch-converting agent was present in the urine of diabetic patients. It was also detected in the fluid aspirated from a case of ascites.

Breusing is of the opinion that the ferment converts the starch only into one of the substances produced before the final change into glucose takes place.

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### On the Correlation of the Secreta and Excreta of the Organism.

At the suggestion of Professor Riegel, Sticker and Hübner (*Zeitsch. f. klin. Med.*, B. xii. H. 1 and 2, 114) have attempted to discover whether the absence of free hydrochloric acid in the gastric contents in cases of carcinoma of the stomach, could be explained in any way by testing the degree of acidity of the urine at different hours in the day. After a series of extended researches they reach the following conclusions:

1. The reaction of the urine is subject to physiological variations, which show a constant dependence on certain processes going on in the organism.

2. The most important of these, in this connection, is the secretion of the digestive juices, especially those of the stomach and pancreas. Muscular action, and perhaps menstruation and psychical action, is of less importance.

3. If the various processes referred to are not going on, the urine preserves during this time and without variation the usual mean of the acidity of the twenty-four hours.

4. The absolute acidity of the urine passed during the twenty-four hours is constant for each individual under an approximately uniform state of the nutrition. It varies for different individuals, both in physiological and pathological conditions.

5. The acidity of the urine is chiefly or entirely dependent on the formation of free hydrochloric acid in the organism, and its retention there. If it is artificially or accidentally (as by vomiting, etc.) removed, the urine suffers as regards its absolute acidity.

6. The graphic curve, showing the variations of the acidity of the urine at different hours in the day, is in consequence of the predominating influence of hydrochloric acid in the reaction of the urine, in a certain sense the expression of the intensity of the digestive power of the stomach.

7. This curve has, however, no semeiotic value in pathological conditions, since other processes in the organism, especially the secretion of the pancreatic juice, may disturb or destroy its typical appearance.

### On Digestive Ferments in Normal and Pathological Urines.

Following the investigations of Holvotschiner, who found, both in normal and pathological urine, an amylolytic ferment having the power of converting starch in solution into both dextrin and sugar, Breusing (*Virchow's Archiv*, vol. 107, p. 186) made a series of experiments, using more exact methods than the first observer for the detection of the sugar.

He found that on mixing varying quantities of a one per cent. solution of boiled starch with urine and keeping the mixture for twenty-four hours at a temperature of 37.5° C., no starch was to be found with the iodine test at the end of that time. Iodine gave a brown, yellowish, or rose color when added to the solution. With Moore's test—the only one Holvotschiner had used—a distinct brown coloration appeared, but on more careful examination it was found that this did not arise from the presence of sugar. Trommer's test was reduced only after *boiling* for two to four minutes (glucose reduces it at once and before the boiling-point is reached), and the fermentation test—the most conclusive of all we have for sugar—gave absolutely negative results. No difference could be observed in the action of pathological or normal, or of night or day, urines. To prove that the amylolytic action is really due to the presence of a ferment, Breusing separated the ferment by precipitation with an excess of absolute alcohol, in the usual way, and found that it acted, when alone, upon solutions of starch the same as it did when in the urine. Boiling the urine destroyed its action.

He presumed that in diabetes this ferment might possibly be absent on account of its having been consumed in the body in the conversion of starches to glucose. But the examination of a specimen of diabetic urine, containing 5.8 per cent. of glucose, showed it to act even more powerfully and rapidly than normal urine, indicating the probable presence of a large quantity of this ferment.

[These experiments show that urine contains an amylolytic ferment capable of converting boiled urine into some of the preliminary stages of glucose, namely, the various dextrines known as erythro- and achroo-dextrines, whose presence was denoted by the various colors of rose and yellow and brown assumed by the solution on the addition of iodine, but that the conversion is not carried to the final product—*i. e.*, glucose.]

It is interesting to note, in this connection, that Mya and Belfanti (*Centralblatt f. klin. Med.*, 1886, No. 42) found that in 28 cases of Bright's disease (4 acute, 24 chronic), the trypsin normally found in urine was invariably absent, while pepsin was nearly always present. In febrile and physiological albuminuria, on the other hand, the trypsin was never absent. This difference might, in doubtful cases, serve as a means of differential diagnosis. The method of determination employed consisted in soaking 2 grammes of fibrin in 500 c. c. of urine for three hours, then pressing out the excess of urine and transferring the fibrin to a 1 : 5 per cent. solution of borax, and keeping it thus at a temperature of 37.5° C. for twenty-four hours. The borax solution prevents putrefaction. One-half of the fibrin was used to determine the trypsin and one-half for the pepsin. After a twenty-four hours' digestion, the amount of fibrin remaining after washing and drying determined the amount digested.

### Reducing Substances, other than Glucose, in Diabetic Urine.

Struck with the discrepancies in the quantitative results obtained by subjecting the same specimen of diabetic urine to the fermentation, the copper-oxide reduction, and polariscopic tests, respectively, Leo (*Virchow's Archiv*, vol. 107, p. 99) endeavored to discover the source of these errors. He succeeded, after removing all the ordinary reducing substances, as uric acid, creatinin, coloring matters, etc., in finding a new substance belonging to the sugar series, and with the power of strongly reducing the copper-oxide solutions, whether as Fehling's or Trommer's tests. This new substance, for which no name has as yet been proposed, is isomeric with glucose. It turns the polarized ray to the *left* —26.73°, and hence, when present, makes the polariscopic readings for diabetic urine indicate a lower percentage of glucose than is actually present. It reduces copper-oxide solutions; 10 c. c. of Fehling's solution corresponding to 0.1242 grain, or one molecule, corresponding to 2.012 molecules of sugar. In using this test, therefore, larger quantities of glucose than are actually present will apparently be obtained. It is not fermentable, and this property distinguishes it from all other sugar-like bodies found in the urine, and at the same time proves the value of fermentation as a test for glucose, for, besides glucose, only levulose, whose occurrence is very rare, is fermentable.

This substance was found in 3 out of 21 cases of diabetes. It did not occur in a large number of normal urines examined.

### Serum-albumin in Normal Urine.

Posner (*Virchow's Archiv*, vol. 104, p. 1) has made careful investigations to settle this much-disputed point, with the result of showing that a minimal amount of serum-albumin is a constant constituent of normal urine. This is important in view of the significance which is attributed by many to the detection of almost infinitesimal quantities of albumin by such delicate reagents as the potassio-mercuric iodide, picric acid, etc. When we consider the constant presence in the urine of albuminoid anatomical elements, it is not surprising that their disintegration and solution should liberate an amount of albumin which, though small, is still appreciable.

## SURGERY.

### In Europe.

UNDER THE CHARGE OF

FREDERICK TREVES, F.R.C.S.,

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### Recent Surgical Literature.

The last new volume of the *Dictionnaire Encyclopédique des Sciences Médicales* runs from "Uri" to "Ute." The article on the urinary passages is completed. Under the heading of "The General Pathology of the Urinary Passages," M.

ROCHARD discusses retention, incontinence, and extravasation of urine, and urinary abscess. The matter is a little spun out. The paper that follows—"A Monograph on Urinary Fistulæ," by M. MONOD, is the best in the volume. He deals with fistulæ of the kidney, ureter, bladder, and urethra, and with fistulæ in women. The article is very complete and is a masterpiece of elaborate work. A very short paper on calculi, by M. DERBOULLET, deals merely with the general chemical characters of urinary stones. The rest of the volume is taken up with the article "Urines" and the commencement of the series of papers on the uterus.

*Die Allgemeine Chirurgische Pathologie und Therapie*, by DRS. BILLROTH and WINIWARTER (Berlin, 1887). This is a new edition (the thirteenth) of Billroth's well known work on general surgical pathology and treatment. The book has been revised by Dr. Winiwarter and brought up to date. It still remains the best text-book on surgical pathology.

*Études Experimentales et Cliniques sur la Tuberculose*, edited by M. VERNEUIL (Paris, 1887). This is the first fasciculus of a work on tuberculosis and is the outcome of an organized effort to solve the mystery of this affection. It contains papers by a great many authors, and the whole volume is filled with original matter of the greatest value. The papers of the greatest surgical interest are the following: LANNELONGUE, on "External Congenital Tuberculosis;" RECLUS, on "Primitive Tuberculosis of the Scrotum;" VALUDE, on "Ocular Tuberculosis;" DEMARR and VERNEUIL, on "The Generalization of Tuberculoses after the Ablation of a Primary Tubercular Disease;" VERCHERE, on "The Treatment of Scrofulous Neck."

*Die Typischen Operationen*, by DR. EMIL ROTTER (Munich, 1887). This is a very compact little work on the chief operations in surgery. It is very ingeniously arranged and is intended in reality to be a handbook.

The chief points of each operation are given clearly and the descriptions are brief but good. The anatomy of each operation is given in detail, and excellent diagrams of the stumps of several amputations are given so as to show the position of the bleeding points.

*Anleitung zur Wundbehandlung*, by DR. SCHAECHTER (Wiesbaden, 1887). This large work forms a complete treatise upon the treatment of wounds and is a production of conspicuous merit. The author deals in the first place with the pathology of wound-healing and thus introduces the inevitable bacillus. Then follow chapters on sepsis and the complications of wound-healing. The main part of the volume is occupied by the treatment of wounds in general and of wounds of special parts. The list of materials for dressing described under the heading of general treatment is remarkable and alarming.

*Tumeurs de l' Ombilic*, by DR. VILLAR (Paris, 1887). This is a work peculiar to French industry, a substantial volume on tumors of the umbilicus (excluding hernia). The following is the classification adopted by the author:

*Benign.* Vascular: angioma, lymphocele. Granuloma: the fungus of the newly born. Adenoma: intestinal, gastric. Cysts: sebaceous, dermoid. Fibro-papilloma. Myxoma.

*Malignant.* Sarcoma, epithelioma, carcinoma.

Nearly ninety illustrations are given. There is an exhaustive bibliography The illustrations are very poor.

*Die Allgemeine Pathologie oder die Lehre von den Ursachen und den Wesen der Krankheitsprocessen*, by DR. EDWIN KLEBS (Jena, 1887). This is the first volume of an ambitious work (on general pathology or the science of the causes and action of disease-processes). The volume is disappointing because nearly the whole of it is occupied with descriptions of bacteria. The author deals—in the 500 pages of this volume—with such diseases as are conspicuously associated with microörganisms. The work is admirably done and the illustrations are excellent.

*Das Venerische Geschwür, Vorlesungen über dessen Pathologie und Therapie*, by DR. E. LANG (Wiesbaden, 1887). This admirable work on the pathology and treatment of venereal ulcers comes from the pen of a well-known author. The subject is exhaustively dealt with and the chapters on exceptional venereal sores and on differential diagnosis are especially valuable. The author's conclusions are founded upon ample clinical material and a wide experience.

*Uber die Excision der Syphilitischen Initialsklerose*, by DR. J. BÖHN (Breslau, 1886). This dissertation discusses the question of the value of excision of the primary sore in syphilis. The author is of opinion that the measure may entirely prevent the development of constitutional syphilis. He allows that the treatment is not always successful, and is unable to give the data upon which the chances of failure may be estimated. The work is of special value as giving a full bibliography of the whole of this vexed question.

*Die Epistaxis und ihre Behandlung*, by DR. BAUMGARTEN (Vienna, 1886). This is an elaborate treatise upon the pathology and treatment of epistaxis. The account of the anatomy of the nasal mucous membrane is very full. The etiology of epistaxis is fully dealt with, as is also the question of treatment. In the latter direction it cannot be said that any very new matter is introduced.

*Dell' Artrectomia Pargiale e Totale*, by D. E. PAOLI (Turin, 1887). A full account is provided of the operation of arthrectomy. Details are given with regard to each individual point. The more practical part of the work is founded upon an account of 20 cases. Among this number were 14 cases of strumous joint disease. 13 of these ended in cure, with useful limbs, and 1 died of general tuberculosis. The author regards total synovial arthrectomy as an excellent means of promoting fibrous ankylosis. He applied it with success in a case of chronic synovitis with loose bodies in the joint and undue mobility of the limb.

*Transactions of the Academy of Medicine in Ireland*, Vol. IV. (Dublin, 1887). In addition to certain surgical papers that have been already noticed, the present volume contains the following contributions: "The Advantages of the Principle of Dry Dressings in Antiseptic Surgery," by DR. BANKS; "The Surgery of the Suakim Expedition," by DR. TOBIN; "Electrolysis in the Treatment of Urethral Stricture," by MR. HAYES.

*Die una speciale medicazione abortiva dell' erisipla*, by DR. ARNICI (Rome, 1886). In this small but ambitious work the author claims to have discovered the abortive treatment of erysipelas. He makes use of an alcoholic solution (apparently 1 in 1) of carbolic acid. This is painted freely over the skin on and about the margin of the spreading erythema. The solution is applied, not only to the reddening edge, but also to the sound skin for a few centimetres beyond that edge. Two or three applications are made within a few hours. No local trouble is said to follow. The pain that arises is checked by the use of cold. He thinks the paint acts partly as a caustic, partly as an antiseptic. He has treated 12 cases of erysipelas by this means, and 2 examples of lymphangitis. In all an immediate and rapid cure followed.

*Die Pathologie und Therapie der Gelenkentzündungen*, by PROF. MAX SCHULLER (Vienna, 1887). A short, but excellent and complete account of inflammatory affections of the joints. Prof. Schüller's valuable work upon scrofulous joint disease is well known. This monograph embraces the whole subject. It is well written, well arranged, and full of original matter. It is up to date, and concludes with an exhaustive bibliography.

*St. Thomas's Hospital Reports*, vol. xv. (London, 1887). The following are the chief surgical papers: "Three Cases of Nerve Suture," by SIR WILLIAM MACCORMAC. In one case the ulnar nerve was united by suture six years after division. Restoration of nerve function followed. "Pre-prostatic Puncture of the Urethra," by MR. MAKINS, a valuable paper, giving an analysis of 46 cases. "Neurectomy of the Second Division of the Fifth Nerve," by MR. CLUTTON. The operation was performed for intractable neuralgia. "Nerve-stretching of the Inferior Dental Nerve for Neuralgia," by MR. BERNARD PITTS.

*Westminster Hospital Reports*, vol. ii. (London, 1887). The two surgical papers in this volume are the following: (1) "Solid Abdominal Tumors," by MR. COWELL—an account of three interesting cases. Two were ovarian fibromata, and the third a fibroma of the round ligament. (2) "Rheumatic Osteitis," by MR. MACNAMARA. An elaborate and valuable paper, with two illustrative cases.

*Diseases of Bones and Joints*, by MR. MACNAMARA (third edition, London, 1887). In the present edition many chapters have been rewritten, much new matter and many excellent illustrations have been added, and the book is brought well up to date.

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### BACTERIA AND TUBERCULAR ABSCESS.

DR. FARRÉ (*Deutsche med. Wochenschrift*, 1880, No. 84) has published an important paper on this subject. He has examined 30 cases of cold or tubercular abscess. In only a very few instances were bacilli found in the pus. In the cases in which no bacilli were detected cultivation experiments led to nothing. Small quantities of the pus that was free from bacilli were injected into animals with the usual precautions. In every case tuberculosis followed. Here, then, is an example of tuberculosis produced by inoculation with a

material that contained no tubercle bacilli, and yielded none of the cultivation. The paper is largely occupied by the author's theories to meet this fact. Incidentally the following data are given for the separation microscopically of tubercular pus from simple inflammatory pus. In the latter the cells are long and well preserved; there is little or no débris, pyogenic cocci are present. In the former the cells are ill formed, many are wasted. There is much fatty débris, and no cocci.

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### The Use of Iodol.

Dr. F. J. Pick (*Vierteljahrsschrift für Dermatologie und Syphilis*, 1886, p. 583) has used iodol in 93 cases with the following results. It is excellent in the treatment of catarrhal affections of the genitals, especially in women. It is also of considerable use in moist condylomata, but is of less value in the treatment of venereal ulcers. It has proved of but moderate value in the dressing of gummatous ulcers and buboes.

The drug has been given internally, but without any benefit. The author points out that when iodol is given internally the iodine reaction is obtained in the urine. No such reaction is observed after local application of the drug.

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### A New Micrococcus.

Professor Manfredi (*Fortschritte der Medicin*, Bd. iv. p. 713) claims to have added another coccus to the already bewildering list of microörganisms.

The author founds his discovery upon two fatal cases of croupous pneumonia. In the sputa in these cases he found, in addition to the usual pneumonic bacillus, another specific bacillus of extraordinary properties. It was of oval shape, and was easily cultivated upon gelatine. The cultivation area was at first a delicate blue, and then a pearl gray, with sinuous margins. The inoculation of dogs and rabbits led to a fatal issue in seven to twelve days. Before death there occurred an enormous swelling of the spleen, and great hypertrophy of the lymphatic glands. The tumors were composed of granulation-like tissue, and rapidly caseated. The lungs were the seat of pneumonia, and also of like granular masses.

The author terms the bacillus "The micrococcus of the progressive lymphoma," and considers it the cause of the neoplasms that developed in the animals' bodies.

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### The Incubation Stage of Hydrophobia.

Dr. Bauer (*Centralblatt für Chirurgie*, January 1, 1887) deals with 537 examples of this disease in man, in which the period of incubation is stated. 10 cases are rejected as doubtful, and 17 in which it is asserted that the incubation stage extended beyond 15 months. In the remaining 510 cases the average incubation period is 72 days. So far as can be shown, the primary treatment of the wound has no effect upon the duration of this period. The following factors in influencing the length of the period between the time of the bite and the appearance of symptoms are evident.

*Sex.* In males the average period is 80 days; in females, 65 days.

*Age* has considerable influence, the stage being shortened by 20 days in patients under 14 years of age.

*The Infecting Animal.*

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Bite from | wolf, | 49 | cases, | average | incubation | stage, | 39 | days. |
| " " | dog, | 293 | " | " | " | " | 73 | " |
| " " | fox, | 2 | " | " | " | " | 33 | " |
| " " | cat, | 31 | " | " | " | " | 80 | " |
| " " | cow, | 1 | case, | " | " | " | 30 | " |

## The Treatment of Erysipelas.

Dr. Nussbaum (*Allg. Wiener med. Zeitung*, 1887, No. 1) advises ichthyol for the treatment of erysipelas migrans. It is applied in the form of an ointment, composed of ichthyol and vaseline, in equal parts. This is applied over the spreading margin. The part is then covered with a 10 per cent. salicylate wadding. The measure has been tried in 5 cases, with uniformly good results.

## Cancer of the Breast.

Mr. H. T. Butlin (*British Medical Journal*, 1887, vol. i. p. 436) gives the result of the investigation made upon this subject by the Collective Investigation Committee of the British Medical Association. The returns number 210.

1. *The influence of mastitis in the production of cancer.* Out of 174 instances previous inflammation or abscess of the affected breast had been noted in 27 cases. No such disturbance had been noted in the remaining 147 cases. From the returns it may be gathered that a previous mastitis plays a quite unimportant part in the etiology of cancer. In nearly one-half of the cases 20 years had elapsed between the inflammation and the appearance of the tumor. The form of inflammation that would seem to predispose to cancer is one that is continuous, or liable to frequent recurrence, or the seat of a chronic irritation.

2. *The influence of inheritance.* Out of 184 cases, in 116 there was no family history of cancer; in 68 there was. The manner of distribution in the 68 cases was as follows: 44 patients had only one cancerous relative, 19 had 2, 3 had 3, and 2 had 4 cancerous relatives apiece.

Thus the 68 patients had among them no less than 99 cancerous relatives.

In only 30 instances were the parents, grandparents, or great-grandparents of the patient cancerous.

There is thus a history of cancer in the direct line of descent in no less than 20.6 per cent. of the cases.

3. *The influence of diet.* Out of 194 returns 123 patients are stated to be moderate feeders, 57 small feeders, and 12 large feeders. The tables do not support the statement that cancer is more common in large eaters of meat.

4. *The influence of locality.* The returns under this heading, as well as under the previous one, are scant and unsatisfactory. Town, as compared with country, and high elevation, as compared with low, would appear to have no influence in the etiology of cancer.

The returns agree, to a great extent, with the conclusions of Mr. Haviland, who finds the lowest rates of mortality from cancer in those parts of England and Wales which are composed of the hardest and most elevated rocks, or

the most absorbent (like the oölite and chalk); and the highest rates in the sheltered and low-lying grounds which are composed of crag, alluvium, and clay.

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### Excision of the Knee.

Mr. Morrant Baker (*British Medical Journal*, 1887, vol. i. p. 321) points out the difficulty of maintaining the bones in position after the operation, and proposes the following procedure, which he has carried out with success:

After the bone-ends have been resected the tibia and femur are fixed together by means of two strong steel pins. These are made to transfix the tibia and bury themselves in the femur. They are so introduced that they cross one another, St. Andrew's cross fashion. The tibial end of the pin is left projecting beyond the skin. The pins are removed as soon as they become loose. This may occur at the end of a few days, or not for a period of from four to seven weeks. The paper concludes with 14 illustrated cases.

Mr. Howard Marsh (*Ibid.*, p. 389) favorably considers Mr. Baker's operation. Mr. Marsh recommends the splint described in Gant's *Practice of Surgery*, 2d edition, vol i. p. 16, and employs bone pins instead of those made of steel. Ordinary bone knitting needles are used. The holes in the tibia are bored by means of a bradawl, the ends of the knitting needle are sharpened, and when they have transfixed the tibia are driven into the femur by a few taps from a mallet. The pins are cut short, and are left permanently *in situ*. Mr. Marsh has used these bone pins combined with Mr. Gant's splint in nine cases.

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### Internal Derangements of the Knee-joint.

Professor Annandale (*British Medical Journal*, 1887, vol. i. p. 319) includes the following conditions under this term (excluding "loose cartilages"): 1. Displacements of the semilunar cartilage. 2. Growths in the interior of the joint. 3. Growths from the bone protruding into the joint.

1. One or other of the semilunar cartilages (most frequently the internal one) is liable to be displaced and to interfere with the joint movements. The displacement is, as a rule, slight. The anterior attachments of the cartilage are those which are most frequently separated. The displacement may take place suddenly, due to a twist or wrench, or may occur gradually from the excessive use of certain movements, especially kneeling. Displacement of the inner cartilage is usually produced when the leg is rotated outward, and of the outer cartilage when it is rotated inward. The operation the author adopts in this condition is the following: An incision is made over the cartilage in a horizontal direction, extending backward from the edge of the patellar ligament about three inches. The joint is opened. The cartilage is replaced and fixed in position by catgut sutures that take hold of the periosteum and fascia about the upper end of the tibia.

2. Three examples are given—two of lipomata and one of myeloid sarcoma. In the former a fatty growth from the synovial membrane over one of the semilunar cartilages was present. It was removed and perfect recovery followed. The sarcomatous growth was the size of a horse bean, and grew from the synovial membrane. It was successfully removed. In these three cases

symptoms were present that closely resembled those due to displaced semilunar cartilage.

3. In this case—a solitary example—a bony growth, due to chronic rheumatic arthritis, grew from the lower end of the femur. It caused much impairment of the movements of the joint. It was removed and a successful result followed.

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### Amputation in Diabetic Gangrene.

Professor König (*Centralblatt für Chirurgie*, No. 13, 1887) has contributed an interesting paper on this subject. He points out that diabetic patients are liable to a low form of inflammation; that their tissues present a favorable nidus for the development of microörganisms, and show a ready disposition to necrose. He suggests that in all cases of apparently spontaneous gangrene, or of gangrene from trifling causes, the urine should be examined for sugar.

In inflammatory affections, in necrosis, and in gangrene occurring in diabetic subjects, the first and most persistent treatment should be by the use of antidiabetic measures. Amputation should not be entertained until the diabetic symptoms are retrograde. If in spite of treatment and careful local antiseptic measures, the local and general symptoms do not improve, then operation must be undertaken as a possible means of saving the patient's life.

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### Reduction of Shoulder Dislocations.

Dr. Macleod (*British Medical Journal*, 1887, vol. i. p. 507) claims for the method of reduction he describes the following advantages. It is easy, rapid, painless, needs no anæsthetic, apparatus, or assistants, and probably does no injury to the joint.

The method may be described as lateral extension in the supine position.

Place the patient on his back on the floor with the arm at right angles to the body, and tell him to lie still and make no effort. The surgeon, sitting on the floor at right angles to the patient's body, places his heel in the axilla, quietly takes the limb by the wrist and upper arm, and pulls in a line at right angles to the line of the trunk, at first gently and then gradually increasing up to a force of a few pounds—the arm being still on the floor, or but slightly raised from it. As reduction may take place without any intimation, to ascertain if this has occurred the hand may be placed on the joint, or the limb adducted. If necessary, repeat the traction with a greater degree of force, and should all the force that can be applied short of giving pain, fail, gentle rotation of the limb, first in one direction and then in the other, can also be made with traction. The supine position is the only one in which the muscles are completely relaxed. The abducted position removes all strain from the deltoid, and the limb is placed in the same posture, probably, that it occupied at the time of the accident.

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### Subluxation of the Lower Jaw treated by Operation.

Professor Annandale (*Lancet*, 1887, vol. i. p. 411) points out that this condition is due to displacement of the interarticular cartilage. Such displacement is most common in delicate women, and is due either to inflammatory changes of a simple, gouty, or rheumatic nature, or to a sudden tearing or gradual stretching of the connections of the cartilage.

The author proposes to relieve the condition by an operation similar to that which he has described for the relief of displaced semilunar cartilage of the knee-joint. An incision slightly curved, about three-quarters of an inch in length, is made over the posterior margin of the external lateral ligament of the joint, and is carried down to the capsule. Any small bleeding vessels having been secured, the capsule is divided and the interarticular cartilage is seized, drawn into position, and secured to the periosteum and other tissues at the outer margin of the articulation by a catgut suture. Two illustrated cases are given in women aged respectively thirty-eight and eighteen. In both the condition was perfectly relieved.

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### The Surgical Treatment of Pulmonary Cavities.

Mr. Rickman Godlee (*Lancet*, March 5, 1887, *et seq*) has published two important lectures on this subject. The paper opens with an account of the history of this branch of surgery. Mr. Godlee traces the surgical treatment of pulmonary cavities back to the time of Sir Edward Barry, in 1726.

The following are the conditions in which surgical interference may be or has been attempted: 1. Tubercular cavities. 2. Cavities resulting from gangrene of the lung. 3. Cavities resulting from the bursting into the lung of abscesses or other collections of irritating matter from without. 4, Bronchiectasis, from whatever cause arising, and including those which depend upon the presence of a foreign body in the air passages.

Gangrenous cavities resulting from some form of pneumonia are the most promising to deal with.

The author lays stress upon the difficulty of dealing with a non-adherent pleura. "The right method of procedure in such a case, though I confess it is not a very easy one, is carefully to stitch the lung up to the opening which has been made in the chest walls."

The first lecture concludes with a series of illustrative cases from various sources and from the author's own practice.

The second lecture gives a most valuable account of the anatomy of the bronchi, illustrated by excellent diagrams. The author follows in the main Abby's account of the parts. The position of the principal bronchi with reference to the thoracic wall is given in detail.

The practical outcome of the anatomical facts is expressed as follows: 1. Foreign bodies of any considerable size will probably lodge somewhere in the main right bronchus at a distance not greater than three inches from the middle line. 2. As regards bronchiectases the smaller peripheral bronchi often serve as the starting-points for excavations of considerable size. 3. Arteries follow with great regularity the posterior surface of the bronchi. They are of considerable size, and would almost certainly be divided in any attempt to open a main bronchus from behind.

With regard to the treatment of bronchiectases, the author writes: "Our main objects in attempting to open a bronchiectatic cavity are: (1) That the secretion from it may be prevented from continuing the mischief in its passage over the bronchi, or as it is drawn down into other parts of the lungs; (2) that the cough may be diminished, it being held that the expiratory efforts have something to do with the production of the dilatation; and (3) because it is

well known that, though patients with this disorder may go on for a number of years without succumbing to it, a very large number become comparatively soon affected with some form or other of blood poisoning. With these objects in view, I should feel disposed to recommend an operation if the physician were to express a strong opinion that the cavity was a single one, or at least that the mischief was principally caused by one main cavity, and also in those cases where it has arisen from the irritating presence of a foreign body in one of the bronchi. In the latter case it would be done in the hope of removing the foreign body; in the former, in the fear that, notwithstanding the diagnosis of a single cavity, there would be found others in the same lung, and not improbably in the other lung, which, it may be, was supposed to be sound."

Illustrative cases of the surgical treatment of bronchiectases are given.

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### Contusion-pneumonia.

Dr. A. Koch (*Dissertation-Munich und Centralblatt für Chirurgie*, No. 10, 1887) gives what little is to be given of the history of this disease, and adds the following case: A man, aged thirty-eight, fell from a great height and received a severe contusion of the left thorax. He however continued with his work after the accident and also on the second day. Toward the end of the second day he began to feel ill and experienced a severe pain in the chest. He went to the hospital, where he died three hours after admission. The post-mortem showed croupous pneumonia with red hepatization. The lung swarmed with the bacilli of pneumonia. The ribs were not injured. The patient was entirely free from disease at the time of the accident.

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### The Surgical Treatment of Empyema.

Dr. Kasanli (*Vratch*, 1866, Nos. 13 to 18) deals with this subject in a very exhaustive manner. The paper commences with an account of the history of the operation. 21 cases of empyema are dealt with. The subjects were young soldiers under care in a military hospital. Of the 21 patients, 10 died; 5 of tuberculosis, 1 of tetanus, 1 of pericarditis, 1 of pyæmia, and 2 of exhaustion. Of those who recovered, 8 are reported as being perfectly cured and 3 as recovering with a persisting sinus. The operation was the same in all cases, and was as follows. A rib is not removed. The fluid—especially when of large amount—is removed very gradually day by day through an aspirator. When the thorax is nearly empty an incision is made under antiseptic precautions, and a drain introduced which is carried into a vessel containing a solution of corrosive sublimate. A clamp is applied to the tube so as to allow of the slow discharge of the pus. In twenty-four hours the wound is enlarged still more, free drainage with a large open tube carried out for the first time. The tube is removed on an average on the thirty-fourth day. Recovery may be expected by the forty-fourth day.

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### The Surgical Treatment of Affections of the Pleura and Lungs.

Dr. Rochelt (*Wiener med. Presse*, 1886, No. 32) comes to these conclusions: In acute pleuritic effusions the fluid should be removed at once by

aspiration. In cases of chronic effusion the fluid should be withdrawn gradually by repeated tappings.

Empyema should be treated by free incisions. He gives an account of two cases of pneumothorax in phthisis treated by operation. One recovered, one died. An excellent case of bronchiectasis is reported that was cured by pneumotomy. The patient was fifty-four and the subject of chronic bronchitis. Portions of ribs were removed and the lung cavity opened and drained. Two cases of lung abscess were treated by incision. Both died; while one case of gangrene, treated by the same measure, ended in recovery.

Dr. Ribbing (*Eira*, 1886, No. 16, Sweden) deals with sixteen cases of empyema, all treated by operation. Strict antisepsis was employed and free drainage. In no case did death result. In children the author considers that simple incision is sufficient. In adults, when relapse occurred, portions of ribs were resected. Washing out of the cavity is not ordered unless the pus be putrid. In all cases the evacuation of the matter should be slow.

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### The Diagnosis of Stricture of the Œsophagus.

Professor Ogston (*Medical Chronicle*, January, 1887, p. 278) points out the difficulties in the diagnosis. There may be dysphagia—depending upon dyspepsia, bronchitis, or post-diphtheritic paralysis—and yet no stricture. Stricture at the lower end of the gullet is most common in patients past middle life, and is due to cancer. In such cases the author lays stress upon the painful distention of the gullet after swallowing, felt in the centre of the thorax and the accompanying breathlessness and sense of distress.

Strictures in the upper part of the œsophagus usually occur in younger subjects, and depend upon cicatrix, diphtheria, or syphilis. In such cases the pharyngeal distention on swallowing can be made out on the left side of the neck.

In making a diagnosis Professor Ogston lays great stress upon the time occupied by the act of swallowing. In healthy subjects the passage of the food along the gullet occupies from two and a half to eight seconds. In cases of stricture it occupies from fourteen to eighteen seconds.

The starting of the bolus is indicated by the movement of the pomum Adami. "If the ear be placed behind the left thorax, three inches below the angle of the scapula, the moment of entrance into the stomach can nearly always be told by a distinct amphoric gurgle or amphoric rushing sound. By noting these two points the time involved in the act of swallowing is indicated."

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### Lipoma of the Mesentery.

M. Terillon (*Bull. et Mém. de la Soc. de Chir.*, t. xii. p. 23) reports the case of a man aged thirty-five, upon whom laparotomy was performed for the removal of a large lipoma. The mass had grown between the layers of the mesentery, and weighed fifty-seven pounds. The patient died of enteritis (followed by peritonitis) on the thirty-second day after the operation.

M. Terillon gives details of 14 other cases of lipoma of the mesentery. 7 were discovered on post-mortem examination, and 7 were removed by operation. Of the latter, only 2 recovered. Death was in each case due to either shock or peritonitis. Mesenteric lipomata occur in adults, and always grow

between the layers of the mesentery. The intestines lie in front of them, or to one side. Ascites is rare, and adhesions are occasionally met with. A correct diagnosis is not usually made, the affection being mistaken for cystic tumors in most instances. Pathologically, the growths belong to the myxolipomata.

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### The Etiology of Peritonitis.

Dr. Grawitz (*Charité Annalen*, XI. Jarhgang, p. 779) has published a very valuable paper upon this subject. It is founded upon an extensive series of experiments made upon the lower animals.

Into the elaborate details of the research it is impossible to enter. The more important conclusions are these: Schizomycetes or Staphylococcus aureus injected into the peritoneal cavity will not of themselves produce peritonitis if the injecting medium be non-irritating. In the production of suppurative peritonitis two conditions are necessary in the majority of cases: 1. The introduction of pus-producing microörganisms; and, 2. The existence of some local disturbance. The latter condition is afforded when the intestinal tube is gorged with much stagnant matter and when the serous membrane has been denuded of its epithelial covering.

The subject of peritonitis from cold is discussed, and Dr. Grawitz concludes that cold alone cannot become a cause of peritonitis, nor does he consider it an important local factor when the other possible causes of peritonitis are present.

The paper concludes with a consideration of the peritonitis that often attends stenosis of the bowel and strangulated hernia. In both circumstances local damage to the serous membrane plays a very conspicuous part.

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### The Treatment of Hemorrhoids by Excision.

Mr. Whitehead (*British Medical Journal*, vol. i. p. 449, 1887) gives an account of no less than 300 consecutive cases treated by means of the operation that now goes by his name.

The treatment by ligature is very unsatisfactory and a relapse is quite common. The treatment by the clamp and cautery is still more unsatisfactory. Its immediate risks are greater and its failures by recurrence more numerous.

The present operation has been performed upon over 300 patients without a death, a single instance of secondary hemorrhage, or one case where any complication such as ulceration, abscess, stricture, or incontinence of feces, has occurred.

The following are the details of the operation: The patient is anæsthetized and placed in the lithotomy position. The sphincters are well paralyzed by stretching. By the use of screws and dissecting forceps the mucous membrane is divided at its junction with the skin round the entire circumference of the bowel, every irregularity of the skin being carefully followed. The external and the commencement of the internal sphincters are then exposed by a rapid dissection, and the mucous membrane and attached hemorrhoids, thus separated from the submucous bed on which they rested, are pulled bodily down, any undivided points of resistance being snipped across and the piles brought below the margin of the skin. The mucous membrane above the piles is now

divided transversely in successive stages, and the free margin of the severed membrane alone is attached, as soon as divided, to the free edge of the skin below by sutures. Bleeding vessels are secured by twisting. A complete ring of pile-bearing mucous membrane is thus removed. No skilled assistance is required. The wound is dressed with iodoform. The sutures are of carbolized silk and are not removed. Castor-oil is given on the morning of the fourth day. The patient can resume work within a fortnight. The amount of pain after the operation is trifling, and retention of urine is uncommon.

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### Hernia of the Cæcum.

Mr. Frederick Treves (*British Medical Journal*, 1887, vol. i. p. 382) commences a monograph upon this subject by an account of the history of the hernia as displayed in surgical literature. In one of the earlier recorded cases (1732) the cæcum was exposed and entirely excised, the patient making a good recovery. Mr. Treves draws attention to the fact that the text-books describe the cæcal hernia as being without a sac. An account is given of the various reported cases upon which this statement is founded, and it is shown that in the more conspicuous instances the evidence is unsatisfactory.

Two cases are given. The first was met with in a man aged forty-one. The rupture was inguinal, the sac was double, and of enormous size. The sac was cut away, the cæcum exposed and reduced. A complete cure resulted.

The second case was in a woman aged fifty-six, and occupied the femoral region. The appendix could be distinctly felt. The hernia was reducible.

The author proceeds to examine 15 recent cases (8 from recent records, 9 from metropolitan museums). It appears that the hernia is much more common in the inguinal than the femoral region, and is more common in males than in females. There is, in nearly every instance, a perfect sac. In a few examples it was incomplete; in no case was it absent. The caput coli may be protruded alone, or in the hernia coils of ileum and omentum may be found. The rupture tends soon to become irreducible.

Mr. G. A. Wright (*Ibid.*, p. 507) gives an account of seven cases of cæcal hernia in children. The patients were between the ages of three months and seven years. They were all males, and the rupture in each instance inguinal. In all the cases operated upon there was a perfect and well-defined sac. The sac may be funicular, or be formed from the open tunica vaginalis.

The paper serves to modify Mr. Treves's statement that "the hernia of the cæcum is practically limited to adults."

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### Parotitis in Association with Abdominal Disease.

Mr. Stephen Paget (*British Medical Journal*, March 19, 1887) has, with great diligence, collected no less than 101 cases of parotitis consequent upon injury or disease of the abdomen or pelvis; of this number, 10 were due to injury or disease of the urinary tract; 18 were due to injury or disease of the alimentary canal, and 23 were due to injury or disease of the abdominal, the peritoneum, or the pelvic cellular tissue. The remaining 50 were due to injury or disease, or temporary derangement of the generative organs. Under the latter term are included slight blows on the testis, the introduction of a pessary, menstruation, and pregnancy.

This form of parotitis appears to be non-pyæmic, to have no definite incubation stage, and to end very often in suppuration. Mr. Paget considers that the sequence of disease is due to influences acting through the nervous system.

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### The Treatment of Ectopion Vesicæ.

Dr. Zesas (*Centralblatt für Chirurgie*, No. 8, 1887) advocates Sonnenburg's operation, which consists in removing the defective bladder and turning the ureters into the penis. The object of the present paper is to describe a special receptacle devised by the author, to be worn after Sonnenburg's operation. It consists of two parts—a rounded concave shield to cover the abdominal wound, and a scrotal funnel, which receives the scrotal tissues and the rudimentary penis, and leads into a tube emptying itself into an ordinary urinal. The shield and funnel are made of silver, and the points of contact are covered with an India-rubber tube, as on the edge of an ether inhaler. A case is described where the appliance was used. The patient was always kept perfectly dry. Excellent illustrations accompany the paper.

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### Suprapubic Lithotomy.

Sir William MacCormac (*British Medical Journal*, 1887, vol. i. p. 551) contributes another valuable paper upon this subject. The article commences with an account of the history of the operation. The modern method is described as follows: Strict antiseptic precautions are adopted throughout. The rectum is distended by an India-rubber bag, of elongated sausage-form. 10 to 12 ounces are injected. The bladder is emptied, is washed out, and then moderately distended with boric solution (6, 8, or 10 ounces). The bladder will then be readily felt above the pubes. The incision is median, is close to the pubes, and from 2 to 4 inches in length. The tissues are divided layer by layer, until the bladder is distinctly exposed. After the viscus has been secured by two loops of thread passed through the muscular coat at the upper exposed part, the cavity is opened. The stone is then removed. In young persons with healthy urine the wound in the bladder may be closed by sutures, in other cases the wound may be left open with or without drainage.

The author gives an account of a series of experiments performed to ascertain the effect of distention of the bladder and rectum upon the position of the peritoneal reflection. When the bladder alone is distended, the peritoneal reflection is somewhat but not sufficiently raised, the bladder being chiefly distended backward. Distention of the rectum alone appears to produce no palpable effect on the vesical fold; and to obtain the maximum result, distention of both bladder and rectum seems necessary. The dilatation of the rectal bag pushes the moderately distended bladder forward and upward against the parietes.

The following indications for the operation are given: A large stone in a contracted bladder, a stone projecting into the urethra, encapsulated or very hard calculi, cases of numerous stones, certain foreign bodies, ricketty deformity of the pelvis, and ankylosis of the hip-joint. Some add hypertrophy of the prostate, stricture, and irritable bladder.

The mortality after the suprapubic method is from 22 to 30 per cent. The

commoner causes of death are (in order) peritonitis, pericystitis, pyelonephritis, collapse.

In 26 cases of suture of the bladder wound primary union was obtained in 10 cases only.

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### Lithotomy.

Dr. Rosenthal (*Vratch*, 1886, Nos. 25–32) gives the following valuable statistical account. He deals with 400 cases of lateral lithotomy. 47 per cent. of the cases concerned patients under seven years of age, and 66 per cent. patients between seven and thirteen years. Out of the 400 only 40 died, a mortality of 10 per cent. In 6 of the fatal cases, death was not directly due to the operation, and the omission of these raises the mortality to 8.5 per cent. The mortality increased steadily according to age, being 3.5 per cent. in patients under five years, and 36.8 per cent. in patients between the ages of thirty and sixty-six.

The mortality in 7628 recorded cases of lateral lithotomy collected by the author is 12.08 per cent. The mortality of the suprapubic operation, on the other hand, stands at 22.1 per cent.

Out of the 40 cases of death, 17 died of pyonephritis. The rectum was wounded 6 times in the 400 operations.

The time occupied in healing averaged 18.6 days in patients under ten years, and 27.2 days in patients above that age.

The character of the calculus was determined as follows: urates, 70 per cent.; oxalates, 11 per cent.; mixed (phosphates predominating), 19 per cent.

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### Primary Sarcoma of the Bladder.

Dr. Chiari (*Prager med. Wochenschrift*, 1886, No. 50) reports a case of this very rare affection. He states that only seven cases have so far been reported. The patient was a boy aged five; the first symptoms were those of retention, followed by the manifestations of chronic cystitis. No blood appeared in the urine until a catheter was used. The tumor could be felt through the abdominal parietes. The tumor sprang from the submucosa about the trigone. The prostate and seminal vesicles were invaded. A solitary gland was found enlarged. There were no other metastases. The growth proved to be a pure spindle-celled sarcoma.

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### The Function of the Prostate.

Dr. Fürbringer (*Berliner klin. Wochenschrift*, 1886, No. 29) states that the prostatic fluid is thin and acid, is rich in albumen, contains lecithin but no fat. The author believes that the fluid has other functions than that of a mere lubricating medium. He states that it acts as a vitalizer of the seminal fluid, and is of essential importance in the act of generation. In semen unmixed with the prostatic secretion the spermatozoa are found to be stiff and still; on the addition, however, of that fluid, they become at once subtle and active. The addition of an excess of prostatic secretion causes the seminal particles to become once more indolent.

These statements are founded upon observations made on animals, and on certain pathological experiments carried out upon the human subject.

## Renal Surgery.

T. F. Chavasse (*Lancet*, 1887, p. 403) gives an account of three cases that proved fatal after operation. In his comments upon these cases the author deduced the following conclusions: To obtain the greatest possible benefit from operative measures renal calculi must be sought for and removed before destruction and consequent abscess have resulted. The signs and symptoms most to be relied upon for the diagnosis of renal calculus, where no tumor exists, the patient being otherwise healthy, are the following: 1. The presence of blood in the urine, especially after erection. 2. Unilateral pain passing down the ureter toward the testis. 3. Pain on deep pressure in loin between the last rib and the iliac rest and just external to the erector spinæ muscle. 4. The presence of uric acid and oxalate crystals in the urine. In suppurative lesions of the kidney nephrotomy and drainage should be the first measure in treatment.

In one case the author passed an exploring needle twelve times into the substance of the kidney, but failed to reveal a calculus and a fair sized abscess that were ultimately discovered post-mortem.

Speaking generally, there is no doubt that the lumbar incision is safer than the abdominal. The author advises nephrectomy under these conditions: After nephrotomy and drainage have failed in cases of suppurative lesions depending upon a local irritant, in hydronephrosis, and in traumatic rupture of the kidney. It is justifiable also in cases of painful floating kidney when attempts to free the organ have failed, and in troublesome renal or ureteral fistulæ. Nephrectomy is contraindicated in tubercular disease, carcinoma in adults, and sarcoma in children.

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The following articles are worthy of note:

"Abscess of the Brain Resulting from Ear Disease," by Dr. Thomas Barr (*Brit. Med. Journ.*, April 2, 1887).

"Pianists' Cramp," by Dr. Warrington Howard (*Brit. Med. Journ.*, March 26, 1887).

"Case of Mollities Ossium in a Male," by Mr. Barwise (*Brit. Med. Journ.*, April 9, 1887).

"Laparotomy in Intestinal Obstruction," by Dr. Kümwell (*Deutsche med. Wochenschrift*, No. 12). Four cases: two of volvulus, one of mesenteric hole, one of solitary band. Laparotomy in each instance, with only one recovery.

"The Theory of Gut Strangulation," by Dr. Beeby (*Centralblatt für Chirurgie*, No. 14, 1887). An examination of Reichel's view, with a new and elaborate theory of the author's.

"Chondromyosarcoma of Kidney," by Dr. Hoiaholt (*Virchow's Archiv*, Bd. civ. p. 118). Male, aged eighteen; left kidney. Died of marasmus. Tumor composed of round-celled sarcoma mixed with muscle fibre and nodules of cartilage.

"Seven Consecutive Cases of Charbon Treated Successfully by Excision," by Thomas Bryant (*Lancet*, 1887, vol. i. pp. 367 and 416).

"Case of Trephining over the Left Branchial Centre for Paralysis of the Right Arm due to a blow a week previously. Cure," by A. W. Robson (*Lancet*, 1887, vol. i. p. 464).

"On Sounding the Frontal Sinus," by Dr. Jurasz (*Berliner klin. Wochenschrift*, No. 3, 1887). The probe is introduced from the nose. The utility of the procedure is not evident.

"Vesical Fistula after a Radical Operation for Hernia," by Dr. Feilchenfeld (*Berliner klin. Wochenschrift*, No. 3, 1887). Male, aged fifty-one; scrotal hernia. Removal of sac with ligature of neck. Urinary fistula formed at wound, which closed after many weeks. The author supposes that a vesical diverticulum must have been engaged in the ring.

"The Classification of Tumors of the Testicle," by Drs. Monod and Arthaud (*Revue de Chirurgie*, March 10, 1887).

"Malformations of the Anus," by Dr. Jeannel (*Revue de Chirurgie*, March and April, 1887).

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## In America.

### Removal of a Large Sarcoma, causing Hemianopsia, from the Occipital Lobe.

Drs. W. R. Birdsall and Robert F. Weir (*The Medical News*, April 16, 1887) make a most important contribution to brain surgery; among other points demonstrating that hemorrhage must be primarily arrested in operations involving the brain structure by reliable methods, such as the ligature, torsion, or prolonged forcipressure, and not by the tampon.

A man, æt. forty-two, in August, 1885, suddenly noticed unsteadiness of gait, succeeded by a violent attack of vomiting. Diplopia for distance soon appeared, with increasing muscular incoördination; numb sensations of the right arm, leg, and shoulder; but no disorder of sensation of the face. All these symptoms were intermittent. Occasional moderate frontal headache was experienced. No vertigo was noticed at first, and no other sensory, motor, or visceral symptoms appeared. Hemianopsia, was detected, with incipient neuro-retinitis. The diagnosis was, "tumor of mesial aspect of right occipital lobe, involving primarily the cuneus, extending downward toward the tentorium cerebelli, and perhaps also upward toward the paracentral lobule (leg centre)." Slight improvement in gait, under the use of iodide of potassium, was observed until as late as July, 1886; but in September the muscular incoördination and occasional drowsiness rapidly increased.

Examination now showed the left lateral hemianopsia still present; the neuritis well advanced, although more marked in the left eye; irides active, both to light and accommodation—the left pupil larger than the right; no diplopia, no "ocular paresis;" the special senses were normal, and there was neither anæsthesia, analgesia, disturbance of the temperature sense, paresis, nor tremor of the muscles; and the motions were "clumsy," rather than ataxic—"uncertainty of control" seemed the best term for it; and the disturbance of equilibrium increased in a most irregular manner.

On March 9, 1887, Dr. Weir operated antiseptically. An oval opening, two and three-quarters by two and one-quarter inches, was made through the bone by means of a trephine and the rongeur. The non-pulsatile dura mater was

opened for two-thirds of the extent of the bone wound, and the tumor, of a purplish-red color, presented at once, covered by a thin cellular layer containing large ramifying veins. By means of a director and spoon-handle, a thin layer of brain substance was loosened from its outer side, and by a continuance of these proceedings the growth was readily separated at the sides; but even after further free removal of bone tissue, the outlying edges and base of the growth could not be reached until it was incised and its softened interior squeezed out. After this, separation was readily effected by the finger-nail until the base was reached, when the growth was nearly torn in half, its outer portion lifted out, separated from the falx, and the whole mass withdrawn. Considerable venous oozing occurred, but was readily arrested by sponge pressure. Two bleeding points were seen: one venous, in the region of the straight sinus; and the other arterial, possibly a terminal branch of the posterior cerebral artery. Moderately firm packing with iodoform gauze to check bleeding, partial suture of the dura mater and scalp, with a careful antiseptic dressing, completed the operation. Some failure of the pulse was observed when the growth was being lifted out, probably due to loss of blood —in all, computed to be from f℥x to f℥xij—but hypodermatics of whiskey relieved this condition.

After the rapid recovery from the anæsthetic, slight divergent squint of the left eye was noted; the pulse was 132, regular, and of good volume. Enemata of milk punch were ordered every two hours. Two hours after operation the pulse was 120, weak, and there was much blood-staining of the dressings.

At 10 P. M. the patient was very restless, with an extremely weak pulse, and steady bleeding was evidently going on. Two quarts of salt solution, as modified by Landerer, were slowly injected into the median basilic vein with immediate improvement in the pulse and consciousness. Slight paralysis of the ocular branch of the seventh nerve was now detected, in addition to the already noted divergent squint on the left side. Hemorrhage being evidently the cause of the unfavorable symptoms, the dressings were removed, but such free bleeding occurred as to forbid anything more than the application of an additional iodoform gauze tampon, and a second transfusion was made; but, despite everything, death occurred at 2 A. M.

Dr. Weir regrets that forcipressure forceps, allowed to remain for from twenty-four to forty-eight hours, with elevation of head, had not been resorted to at the outset. The advisability and dangers of free bone openings are discussed, bone-grafting is advocated, either by dusting the finely minced bone over the dura mater, or by replacement of the trephine disks.

This case makes the eighth operated on for brain tumor. In five instances the growth was found and removed; in one, partial removal was effected; and in the remaining two, no tumor was found, although in one case the post-mortem, two and a half months later, revealed a growth pressing upon the cerebellum and spinal cord.

The growth weighed 5½ ounces, and measured 3¼ inches by 2¾ by 2½ inches thick, the greater circumference measuring 8½ inches.

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### Pleurotomy by Resection of the Ribs for Empyema.

Dr. W. H. Strickler (*The Medical News*, May 7, 1887) describes the following operation: Across the sixth rib in the axillary region a vertical cut of

three inches is made with its centre over the rib. A transverse cut of one inch crosses the primary one at its centre. The sixth rib is bared, partially divided at two points by a Hey's saw, and finally severed by bone forceps. The pleura now being opened the chest is explored by the finger to ascertain the position of the diaphragm, when a section of the seventh and of the fifth ribs is removed—about one inch of these, while the exsected portion of the sixth rib measures one and a half inches; this is to secure space between the extremities of the segments of this rib, when the cut ends of the fifth and seventh ribs are driven together by atmospheric pressure. All bone sections having been completed, the pleural cavity is carefully explored, by the whole hand, except the thumb, all fibrinous masses are carefully removed, any bands likely to prevent expansion of the lung ruptured, and the cavity thoroughly irrigated with large quantities of hot water. All but the centre of the wound is sutured, and gauze and oakum applied over all. After the first week a tube is used to keep the wound patent, which is gradually reduced in size. From the outset, daily flushings with hot water are used. Five cases are reported, which have done well. The operation is a modification of one in general use.

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### Pistolshot Wound of the Abdomen; Laparotomy; Nephrectomy; Autopsy.

Dr. W. W. Keen (*The Medical News*, May 14, 1887) gives the details of a most interesting case, which should be carefully studied by every surgeon, illustrating, as it does, many points which are both new and of practical importance in this latest field of operative surgery. The title contains nearly all the essential points, and since nothing short of an almost complete reproduction of the paper could do it justice, we shall merely add what seems to be the apparent cause of the fatal termination of a case which bade fair to recover, and one or two minor points worthy of comment. Generalized, non-suppurative peritonitis was found post-mortem, and a gangrenous portion of bowel opposite to the ball wound of the intestine, in the centre of the dead portion two perforations existing with pus in the lumen of the bowel. This was probably the cause of the peritonitis, and Dr. Keen thinks resulted from contusion of the mesentery not detectable at the operation, but causing thrombosis of the arterial supply to the portion of bowel-wall which necrosed. An extensive intermesenteric layer of blood effused before, and found at the operation, had also broken down and looked purulent, but did not communicate with the peritoneal cavity. At the post-mortem examination the right kidney was found to have undergone marked compensatory enlargement, which the clinical history indicated must have taken place, since the urine, while scanty at first, gradually increased in three days from ℥iij of albuminous fluid to ℥xl of normal secretion.

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### Splenectomy for Wandering Spleen.

Dr. W. H. Myers reports (*Journal of the American Medical Association*, April 2, 1887) a successful case, the operation being demanded for the relief of septic symptoms induced by abscess, resulting apparently from the pressure of an enlarged and dislocated spleen. The suppuration was unquestionably favored by the post-partum state, the patient having been delivered about three

weeks previously, although the splenic hypertrophy had existed to a marked degree for over one year. The perisplenic abscess had opened externally before operation by three orifices. Strict antisepsis was attempted and secured. The pedicle was transfixed by a double ligature, tied in halves, and dropped into the cavity, and a glass drainage tube inserted. The tumor weighed seven pounds. Recovery was prompt, the patient going home on the twenty-first day.

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### Aneurisms Treated by the Introduction of Catgut or of Wire, with Electricity.

In this most interesting paper (*The Medical News*, April 9, 1887) Dr. Robert Abbe reviews the histories of those cases treated by wire alone, and then relates an instance in his own practice, where the introduction of one hundred feet of aseptic No. 1 catgut into the cavity of a large dissecting aneurism of the right subclavian artery was of temporary benefit. Increase in size occurring after a few days, one hundred and fifty feet of fine sterilized steel wire were introduced through an insulated aspirator needle, the positive pole of a galvano-faradic battery was attached to the extremity of the wire, while a copper plate—12 inches by 12 inches—covered with wet cotton, placed over the back, was connected with the negative pole. A current of fifty milliampères was at first used, finally a very much stronger current, the current being reversed during the latter part of the operation, which occupied one hour. For twenty-four hours decided hardening of the tumor was noted, then it rapidly increased, death resulting on the second evening from rupture into the trachea.

The writer reviews the results of this, and similar treatment, in the practice of others, concludes that, as it has only been tried in desperate cases, we are not able to decide what value inheres to the practice, and thinks that, as it does no harm, it should be still tried—all the more, as the post-mortem results show that in many cases large quantities of firm, laminated clot have been formed, while "the subsequent much-desired inflammation of the sac was easily kept under control by ice-bags in every case." Two cures have resulted from the introduction of wire, while electrolysis alone has occasionally succeeded. In reality, Dr. Abbe has combined both methods—*i. e.*, introducing a tangled mass of easily compressible wire reaching every portion of the sac, and then inducing deposition of clot upon it by electrolysis; in addition, inflammation of the sac, which Cinicelli contends is essential to the success of his method, is induced.

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### A Case of Innominate Aneurism treated by Simultaneous Distal Ligation of the Right Carotid and Subclavian Arteries. Recovery.

Dr. H. R. Wharton records (*The Medical News*, April 9, 1887) the history and results of treatment of a case operated upon by Professor J. Ashhurst, Jr., at the University College Hospital, on November 13, 1886. The right common carotid was ligatured with catgut above the omohyoid muscle, after which the subclavian of the same side was secured just outside the anterior scalene muscle. Silver sutures, drainage tubes, and an oiled lint dressing were used. Neither unpleasant cerebral symptoms occurred, nor did improvement in the aneurism at first take place. In a few days, however, the aneurismal tumor

became smaller, the dyspnœa and dysphagia markedly diminished, and the patient could sleep in the recumbent posture. No radial pulse was detectable even when discharged two months after operation. Examination at that time showed only the merest traces of the previous trouble, so slight, indeed as to warrant the belief that a complete cure has resulted. The recorded cases of this operation are examined and commented upon, the results of consecutive ligation compared, and the opinion expressed that the simultaneous ligation of the right carotid and subclavian arteries for innominate aneurism "is a more efficient and safer procedure than consecutive ligation of these vessels."

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### Three Cases of Ligature of the External Carotid Artery, in two of which both Vessels were tied Simultaneously.

Dr. Jos. D. Bryant (*The Medical News*, May 14, 1887), in a lengthy paper, well worthy of a careful perusal, sums up with the following conclusions: 1. Ligature of the external carotid artery, together with independent ligature of the branches arising from the first inch of its course, is a safe and commendable operation. 2. When the facial and lingual arteries do not arise singly, or by a common trunk, from the first inch of the course of the external carotid, the branches arising at the point of bifurcation of the common carotid should be tied. 3. Simultaneous ligature of both external carotids is a rational preparatory measure for operations involving the parts supplied by their branches when dangerous hemorrhage is feared. If the pharynx be involved, the ascending pharyngeal branches should be ligatured also. 4. Simultaneous ligature is advisable as a final expedient to diminish the rapidity of the development of extensive, malignant growths when they are nourished by the branches of the external carotids. 5. Ligature of one or both external carotids for the cure of aneurismal formations of the branches of the same is not feasible as an independent curative measure. 6. Ligature of the common carotid should not be done for the cure or for the arrest of morbid conditions involving the external carotid or its branches, except as a final resort.

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### The Treatment of Old Dislocations of the Elbow.

Dr. L. A. Stimson reports, in *The Medical News* for April 2, 1887, a case in which arthrotomy was resorted to, and upon the reproduction of the displacement, excision of the joint was done two months after the first operation.

Attention is called to the adhesions formed by the remains of the lateral ligaments and adventitious cicatricial bands between the olecranon and humerus, which take place so far up and behind the centre of motion that reduction can only be effected by a greater degree of force than originally produced rupture of the articular ligaments. Stripping up of the periosteum on the dorsum of the humerus by the head of the radius occasionally takes place, with a consequent formation of bone greatly interfering with reduction. Removal of pressure from a growing epiphysis – *i. e.*, that of the capitellum of the humerus—may result in an overgrowth of this process in the young, while elongation of the neck of the radius may take place from the same cause, both of these conditions preventing reduction. Fractures of portions of the coronoid process, the head of the radius, or of the epitrochlea, may, by subse-

quent bony adhesions in new sites, present insuperable obstacles to replacement of the articular surfaces.

Stimson, in his arthrotomy, made a single, instead of the usual bilateral incision—which latter procedure he announces he intends adopting in the future—divided the olecranon, separated adhesions, reduced the luxation, and then sutured the divided bones with silkworm gut. Owing to the strain exercised upon the olecranon by the tense triceps muscle, the elbow had to be fixed at an angle of 145 degrees, a position which doubtless determined the redisplacement.

Dr. Stimson concludes by stating his acceptance of the rules formulated by Albert for cases of old backward luxation of the elbow, viz., rupture or tenotomize adhesions in the elderly, and if reduction then fails, forcibly flex the elbow to a right angle, with or without fracture of the olecranon, and allow ankylosis to occur. In younger subjects divide subcutaneously all bands, and even the triceps, to avoid fracture of the olecranon; but if the bones cannot then be replaced, arthrotomy should be done by two lateral incisions. Finally, if everything fail, excise the joint.

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## OPHTHALMOLOGY.

UNDER THE CHARGE OF

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### Ophthalmoplegia Externa Acuta.

In the *Edinburgh Medical Journal* for March Drs. Berry and Bramwell report a case of ophthalmoplegia externa acuta in a child of two and a half years, probably due to a scrofulous lesion of the pons Varolii, with subsequent recovery. The authors admit that the exact nature of the lesion must, to some extent, be a matter of conjecture, but were disposed to think that it was probably tubercular from the sudden nature of the attack and the clinical history of the case. The ocular symptoms manifested themselves as follows: Almost complete ptosis of both lids, inability to elevate the eyes, complete loss of the power of depressing them; the internal rectus of the right eye was absolutely, and that of the left almost completely, paralyzed; absolute divergence of the eyeballs, the pupils from four to five mm. in diameter, which contracted promptly to light. There were no visible changes of the fundus oculi. Dr. Berry's diagnosis was paralysis of the third and fourth nerves and paresis of the sixth—*i, e.*, almost complete ophthalmoplegia externa.

By careful examination, no loss of sensation or derangement of motion could be elicited other than could be accounted for by the general apathetic and drowsy condition of the patient. The authors localized the lesion at the top of the pons Varolii and in the neighborhood of the aqueduct of Sylvius, from the fact that the muscles supplied by the third, fourth, and sixth nerves on both sides were involved and vision unaffected. The prompt pupillary

reaction demonstrated that it was not the trunk of the third nerve but only those nuclei connected with the external muscles of the eyeball which were implicated. The fifth nerve was apparently unaffected.

The authors bring to their support the researches in the localization of the motor functions of the eye by Henson and Völckers, Kahler, Pick, and Ferrier. The labors of Henson and Völckers have established the fact of a differentiation of centres of the third pair of nerves, so that each of the ocular muscles, the levator, the superior, inferior, and internal recti, and the inferior oblique, has a distinct and localized nuclear origin beneath the floor of the aqueduct of Sylvius; moreover, the centres for the reflexes of light and accommodation (the iris and ciliary muscle are not only distinct from the preceding but from each other) are placed further forward toward the summit of the third ventricle. From these anatomical differences of origin we can understand how there may be ophthalmoplegia externa whilst the pupillary and ciliary reflexes are perfectly normal; and also how the reflex to light may be abolished with conservation of the accommodative reflex as in the "Argyll-Robertson pupil."

The differential diagnosis between ophthalmoplegia of nuclear origin and that arising from peripheral lesion depends on the following symptoms: In the first instance there is a slow, gradual, and progressive suppression of ocular motility, with a moderate degree of ptosis that may be temporarily overcome by the will, and with normal pupillary and accommodation reflexes. In paralysis of peripheral origin, the failure of function is monolateral, sudden, subject to no changes or intermissions, and if existing, the ptosis is not controllable by the will. This latter phenomenon finds its explanation in the clinical and physiological fact that the levator is the only one of the ocular muscles whose relations with the cortex have been established.

The patient recovered under the internal administration of the iodide of potassium.

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### Imperfect Convergence in Exophthalmic Goitre.

P. J. Möbius (*Centralbatt für Nervenheilkunde*) finds a subnormal converging power in patients with Basedow's disease, the remarkable fact being that the imperfection is independent of the proptosis, since in two cases when the proptosis was marked, convergence was normal, and in the other six cases, varying greatly in the degree of proptosis, the imperfect convergence was decided. The author concludes that the phenomenon is due to the nervous debility, and cites Perinaud, who found a reduced power of convergence in neurasthenic patients.

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### Syphilitic Arteritis of a Retinal Artery.

In the *Correspondenz-blatt für Schweizer Aerzte*, Haab reports a case believed to be unique, of pronounced arteritis of one of the branches of the retinal artery, due to syphilis. The trunk of the artery showed spots of brilliant whiteness, often resembling white scales, whilst in the smaller subdivisions of the branches the change was shown throughout. These lesions were markedly lessened by constitutional treatment directed against the general syphilitic condition.

### Physiological action of Atropia on the Iris.

Dr. H. Höltzke in *Klinische Monatsblätter* for March, asserts that mydriasis of the pupil following instillations of atropia, is caused by paralysis of the nerve endings of the oculomotorius only. His statement is based upon experiments made upon lower animals, where the pupil had been dilated by atropia and the sympathetic nerve severed; the pupil immediately after the operation contracted; by the application of faradization dilatation follows. Contraction and dilatation of the pupil have been observed in a non-atropinized eye, where the same experiment has been made.

Stilling advances the argument that atropine not only paralyzes the nerve endings of the oculomotorius, but also irritates the sympathetic, and brings to his support the fact that in paralysis of the third nerve, due to some lesion, where we have a certain amount of pupillary dilatation (about five mm.), an application of atropia will dilate the pupil still further (8 mm.). He argues that the atropia irritates the sympathetic, thereby producing secondary mydriasis.

Höltzke explains this as follows: Inasmuch as the lesion is along the trunk of the nerve, there still remains a certain amount of force in the ganglion cells situated in the iris or anterior portion of the uveal tract or ciliary ganglion, which gives a certain amount of remnant tonicity to the peripheral ending of the nerve, it being these cells which the atropia affects, and thereby producing the secondary dilatation. Cocaine produces mydriasis of the pupil by its irritant effect upon the sympathetic, hence the secondary dilatation in an atropinized eye. Our author sets forth this fact in support to his primal assertion that atropia only acts physiologically upon the third nerve when applied to the eye.

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### Snow-blindness.

Dr. L. B. Graddy, of Omaha, Neb., had under observation six patients suffering from snow-blindness. They were hunters, following their occupation in a district covered with snow. The intense glare of the sun reflecting from the snow produced the visual defect. The first manifestation of disturbed vision was their inability to outline game (wild geese) below the horizon. The visual defect increased to such a degree that landmarks which guide men on the plains, faded rapidly away, and it was with difficulty that they found their way into camp. Forty-eight hours after the attack, the victims were found by Dr. Graddy suffering intensely with photophobia, lachrymation, conjunctivitis, ciliary neuralgia and, in two cases, complicated by a narrow, horizontal band of superficial keratitis. The patients described their condition as if enveloped in a white, heavy mist. As their faces were sunburned, Dr. Graddy assumes that the pathological condition of the conjuctiva and cornea was of the same character, and the blindness due to molecular change in the retina, caused by over-stimulation.

The treatment instituted was soothing external applications and dark rooms. Recovery followed, with useful vision.

Indians and trappers have an ingenious way of protecting vision, where the glare is intense, by applying around the eyes, and over the cheeks, a gunpowder paste, or goggles made of the untanned skin of animals, fitting closely around the orbit.

### Myopia in the Schools of Stockholm.

In an examination of 1446 school children of Stockholm, Professor Johan Nidmark found no myopia in children of six or seven years of age, whilst among scholars of eight and nine there was, among girls, but one case; among boys 14 per cent.; at sixteen, 33 per cent. of boys and girls were myopic, with an average of —2.5 D. In the highest grades the proportion of myopes among the girls rose as high as 54.28 per cent., with an average degree of —3.5 D., the frequency among boys not being so great, one school (girls) showed a frequency of 66.67 per cent., and a mean of —4.16 D. The statistics show that the injury is greater to the eyes of girls, a result to be expected, both on account of the comparative weakness of females, and the nature of their work outside of school.

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### Silver Balls as Substitutes for the Vitreous after Evisceration.

In the report of the Bristol General Hospital (*British Medical Journal*) two cases of the successful use of hollow silver (instead of glass) balls is detailed, for the substitution of artificial vitreous after evisceration, by Mr. W. P. Keall. The evisceration was thoroughly performed under antiseptic precautions. The ball was of a size easily enclosed by the sclerotic. The opening in the sclerotic was made just outside of the sclerocorneal margin in a horizontal and curved direction, whilst that of the conjunctiva was vertical, in order more effectually to close the hollow of the eye. The wounds were stitched with fine silk thread. The dressing was a pad of boracic lint moistened with carbolic lotion. No pain was experienced from the pressure of the balls, and in a few weeks all inflammation and discomfort had disappeared.

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### Gouty Affections of the Eye.

M. Zychan (*Recueil d'Ophthalmologie*) describes the ocular symptoms consequent upon gout. The sclerotic is most frequently attacked, though the lachrymal ducts, the lids, and other parts are sometimes affected; vascular congestion and swelling are usually the most noticeable objective symptoms; calcareous deposits have been found under the conjunctiva of the upper lids near the margin, producing by the friction (as in trachoma) irritation of the conjunctiva of the globe, photophobia, etc. The deposits may be extracted or picked out with any sharp instrument. If dry eczematous scales form upon the lids, with intense itching, the author recommends dusting the parts with calomel or calomel and morphine combined. The capillary degeneration of gouty subjects is shown by conjunctival hemorrhages and extravasations.

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### Transplantation of Rabbit's Eye into the Human Orbit.

Dr. Charles H. May reports the failure of an attempt of this kind in the *Archives of Ophthalmology* for March, 1887. The attempt is noticeable only because every circumstance attending the whole proceeding was as favorable to success as desired. The patient's health was all that could be wished, the operation was done with skill and care, and with every precaution, antiseptic and otherwise, that could be demanded; the subsequent events were all favor-

able to a successful result, but on the ninth day ulceration of the transplanted eye began to appear, and it was removed. The muscles and optic nerve had united more or less firmly, but the mass of foreign tissue proved too great; its nourishment was impossible under such circumstances.

### Artificially Produced Cataract.

In *La Semaine Médicale*, Messrs. Bouchard and Charrin state that naphthalin produces cataract of both eyes in rabbits; it requires three to four weeks, daily doses of about twenty-five grains, to produce this result.

In examining the functions of the cochlea, Dr. Stein found that the persistent action of a high-pitched tuning fork produced cataract in young porpoises in from eighteen to twenty-four hours. The opacity of the lens passed off in time, but could be reinduced by the tuning fork. In animals whose ears had been destroyed, the cataracts were producible in two or three hours.

### A New Cause of Mydriasis.

Dr. Rampoldi (*Recueil d'Ophthalmologie*, March, 1887) calls attention to bronchial and pneumonic affections as frequent sources of unilateral (sometimes bilateral) mydriasis. He has noted the fact, especially after the patient has passed a sleepless night from cough, and explains the phenomenon as a result of irritation of the cervical sympathetic which supplies the radiating fibres of the iris.

### Cataract Extraction without Iridectomy.

In the *Archives of Ophthalmology* for March, 1887, Dr. H. Knapp reviews the reasons for and against a preceding iridectomy in cataract extraction. His conclusion is: "Simple extraction is an operation of the highest order, and practicable in the majority of cases with the same degree of safety as the extraction combined with iridectomy. In a considerable minority, however, the latter method is preferable; in a number of cases the indications for the iridectomy manifest before, in others only during, the operation." He concludes that an iridectomy should be made when, from fluidity of the vitreous and rupture of the suspensory ligament, or from insufficient section, the vitreous, instead of the lens, presents; when the iris has been injured, when the sphincter is unyielding, when, subsequent to the expulsion of the lens, the iris proves irreducible.

Of the twenty-nine cases detailed which served as clinical proof of the results, there were eighteen "perfect or ideal recoveries"—*i. e.*, the pupil was central and movable, and unobstructed by inflammatory products. The advantages of the operation without iridectomy are evident; there is a normal and active pupil, a natural appearance of the eye, increased acuteness and better eccentric vision, etc. On the other hand, the operation is somewhat more difficult, the section larger, the lens less easily expelled; there is greater danger of prolapse of the iris and posterior synechiæ.

### Irrigation of the Anterior Chamber after Cataract Extraction.

In *Annales d'Oculistique* for January, 1887, Dr. Grandclement, of Lyon, reviews the method adopted, and the nature of the liquid used by MacKeown,

Wicherkiewicz, and Panas for irrigation of the anterior chamber after cataract extractions. Wicherkiewicz reduced the practice to a method for operations upon immature cataracts, instead of artificial maturation. Wecker made these injections, containing a solution of the salicylate of eserine, in order to secure pupillary contraction and to prevent prolapse of iris; Panas requiring not only cleansing, but also antiseptic properties.

Inasmuch as the usual antiseptics, such as the bichloride of mercury or phenic acid, were too irritating, he employed the biniodide of mercury (0.05 gramme to 1000 grammes, with 20 grammes alcohol, at 90°), which he found successful, patients usually recovering in seven days. Grandclement performed four cataract operations, following the details as suggested by Panas, excepting the strength of the solution, which was but half strength, for fear of producing too much irritation.

In the first case the solution was used thoroughly. The vision immediately following the irrigation was excellent, but in twenty-four hours, and still more marked on the second day, the cornea was striated and lacked transparency. The iris and capsular sac became involved and the final result was not brilliant.

The three cases following responded more favorably to the treatment. Our author found the intra-capsular irrigation, as practised with Panas' solution, dangerous, and according to experiments made upon rabbits by Drs. Bettremieux and Vassaux, disciples of Panas, the salts of mercury should be abandoned. For operations upon immature cataracts our author now uses boiled and sterilized water, having abandoned all antiseptic liquids as dangerous and useless, there being no microbes in the eye; besides, the recent investigations and experiments of Prof. Sattler prove that Panas' solution is absolutely too weak to kill the numerous microbes which he found in the lachrymal sac and secretions of the conjunctiva of individuals suffering from catarrhal inflammation of the lachrymal ducts. To destroy the microbes a solution four times the strength would be required—much too irritating to apply to the eye. Boracic, salicylic acid, and other substances reputed antiseptic, Sattler found useless in the destruction of micrococci.

With patients having cataracts and suffering from catarrhal inflammation of the lachrymal canal, our author suggests the application of the sublimate, 20 centigrammes to 1000 grammes, for a shorter or longer time, to the palpebral aperture until a violent conjunctivitis is produced, this is then mastered by astringent washes, and the operation for cataract, or, what is still safer, a preliminary iridectomy performed. Five or six weeks subsequently the lens may be removed through the scar-tissue, which must be less favorable to the evolution of morbid germs. Our author has followed this method with good results, not depending upon boracic acid, which seems too much in vogue to-day. The reviewer has found boroglyceride, fifty per cent. solution, a most efficient remedy is cases as described above.

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### Transplantation of the Cornea.

In Zahender's *Klinische Monatsblätter* for February, 1887, Prof. Adimuk reports his attempts at corneal transplantation into human eyes, emphasizing the recommendation that an adjacent portion of sclerotic be also transplanted.

This is in view of the fact that the cornea is nourished from its periphery, and that the sclerotic heals more rapidly than the cornea. It therefore became necessary to choose some animal having an eye small enough to enable the operator to procure a piece (by trephining) of the requisite tissues and size. Three attempts were made with rats' eyes; the tissues proved too thin and weak to withstand the intraocular pressure of the human eye. But there was union and healing of the transplanted part, and this gave encouragement to other attempts.

Five trials were made with hen's eyes. Two ulcerated, and three grew firmly in place, but these cases subsequently passed out of observation, and no definite results can be stated. The author, however, urges that his partial success renders the method of including a bit of the sclera with the transplanted piece a prerequisite of success. The method whereby this opaque part subsequently becomes transparent by a spontaneous process is hard to believe. It is evident that the success of the endeavors must depend upon a more perfect technique. Personal disappointments and the scepticism of others have not discouraged v. Hipple, who recently successfully ingrafted a rabbit's cornea (4 mm.) in the opaque cornea of a girl seventeen years old. The visual acuity at the end of eight days was $\frac{20}{CC}$. The investigations of Leber upon the liquid changes of the eye have taught us that the transparency of corneal tissue is only protected by the intact state of Descemet's membrane, hence the transplantation is made possible, only if the endothelium of this membrane preserves its integrity. If the membrane is wounded it rolls upon itself, and failure is the result. The method, which is difficult and delicate, is applicable only to non-adherent leucomas, according to von Hipple.

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### Inflammation of the Lachrymal Canal.

Dr. Montanelli (*Bolletino d'Oculistica*) reports that two cases of dacryocystitis, which proved rebellious to the usual line of treatment, responded promptly to the daily irrigation of the canal of a solution of boracic acid (40 in 1000) with one gramme of salicylic acid. The injections were made with a perforated nozzle introduced in the upper lachrymal duct, and this probe attached to a rubber tube terminating in a reservoir placed 90 centimetres above the level of the eye.

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### Ocular Injuries caused by the Obstetric Forceps.

Berger (*Archives für Augenheilkunde*, March, 1887) reports a case of ocular injury caused by obstetrical forceps, which, from its rarity, attracts attention. The levator palpebræ was so injured that the child (of four years) suffered with marked ptosis, and an almost complete lack of power of the rectus superior. Fundus oculi was normal, the refraction hyperopic and astigmatic, vision $\frac{20}{XXX}$. Three other cases of ocular injuries by forceps are all that are recorded in ophthalmic literature. These are by Steinheim, in the *Deutsche medizinische Wochenschrift*, 1883, No. 17.

### Incision of Swollen Optic Nerve Sheath, and Etiology of "Choked Disk."

Mr. Brudenell Carter (*Lancet*, March 26, 1887) reported to the Medical Society of London an interesting and successful instance of incision of the nerve sheath, and escape of the contained fluid, in a case of swollen optic disk. Under iodides and mercury no improvement had taken place, but the symptoms rapidly grew worse. Vision was already seriously threatened. The operation was preceded by a division of the external rectus, and the sheath of the optic nerve was exposed by rotating the eye inward, and the incision made. There was immediate relief from headache. In ten days the swelling of the optic disk had become reduced by one-half, and the recovery was uninterrupted.

The case, he thought, goes far to prove that the pathology of swollen optic disk is primarily dropsical, and only secondarily neuritic. Dr. Carter argued that there was a descent of fluid from the subarachnoid space to the space between the dural and pial sheaths of the optic nerve, and from this cause resulted compression of the nerve, and impeded venous circulation.

Readers interested in this question of the etiology of optic neuritis, will find a thorough *résumé* of Deutschman's researches and experiments in relation thereto in the *Ophthalmic Review* for April, 1887. Deutschman makes it clear that the so-called choked disk is not pathologically distinct from other forms of papillitis, and that the inflammatory process in the nerve is generally an ascending, rather than a descending one. The conclusion reached is that papillitis does not depend upon pressure, but results from an irritating fluid passing from the cranial cavity, and arrested at the bulbar end of the optic nerve, producing there an infective action. This conclusion would, therefore, as necessarily demand the surgical procedure above described, as if pressure, instead of being only a subsidiary cause, were in fact the sole cause. In cases, therefore, when loss of vision is threatened from papillitis of any kind, the indication points to immediate incision of the optic nerve sheath and drainage of the dammed-up retrobulbar infecting fluid.

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### Ophthalmia Neonatorum.

The fifth of Dr. C. Bell Taylor's clinical lectures on diseases of the eye (*Lancet*, April 16, 1887) is devoted to ophthalmia neonatorum, and is a succinct account of the fearful consequences of the common neglect of obstetricians to give but an instant's attention to a simple prophylactic measure.

Of 630 cases treated *in the early stages* by Professors Horner, Schweigger, and Hirschberg, every one recovered with absolutely perfect sight, whilst of 120 cases treated by the same physicians, but *only in the later stages*, 49 became wholly blind. Of the 300,000 blind people in Europe, from one-third to one-half are so from simple neglect of an absolutely certain and well-known precaution.

Credé's method—a two per cent. solution of nitrate of silver dropped into the eyes of *all* newborn infants—should be a public law, neglect of which should debar a physician or midwife for all time. It is an old warning, but it is one that ignored daily produces such a stupendous amount of misery that it seems always *à propos* again to call attention to it.

# OTOLOGY.

UNDER THE CHARGE OF
CHARLES H. BURNETT, M.D.,
PROFESSOR OF OTOLOGY IN THE PHILADELPHIA POLYCLINIC AND COLLEGE FOR GRADUATES IN MEDICINE, ETC.

## Sarcoma of the Concha.

Dr. M. D. Jones, of St. Louis (*St. Louis Courier of Medicine*, Feb. 1887), reports the following interesting case of this rare affection:

A negro, aged seventeen, had a lobulated non-pedicellate tumor about the size of a chestnut, springing from the centre of the right concha, filling it and hiding the orifice of the external meatus. The mass looked glossy, and at first was mistaken for a huge polyp protruding from the meatus. The patient stated that two months previously he noticed a pimple on his ear, which itched greatly. He repeatedly scratched it and removed a scab from it, which was followed each time by moderate bleeding. Suddenly the pimple began growing, and in a few weeks attained its large size. At no time was there pain about the auricle. The growth was removed by a cold wire snare, and proved to be a small spindle-celled sarcoma. Fibro-sarcoma of the lobule is not rare and is generally met in the negro. Sarcoma of the auricle, however, is rare, and the case reported here makes the third one where the cancer was found invading the pinna primarily.

## On the Management of Perforations of the Membrana Tympani.

Sir Wm. B. Dalby believes that perforations possess individualities of their own. (*British Med. Journal*, March 12, 1887.) They display an "infinite variety," in their occasional rapid healing, in their tolerance at times of treatment, and again their intolerance and a great susceptibility to climate and diet, especially to stimulants. It is maintained that in all cases of aural discharge, in young children, the membrana is usually perforated. When examined, a few weeks after the discharge has ceased, the perforations will be found to have closed. We must, therefore, "admit that during infant-life the membrane is extremely prone to become perforated, and, happily, equally prone to heal." It is also worthy of note that the majority of these children hear well when they grow up. Although this fortunate ending is often due in part to the fact that there has been no local interference, "it does not follow that nothing should be done for recent infantile perforations of the membrane." They are better, however, without treatment "if such treatment includes mineral astringents in solution." Sulphate of zinc and acetate of lead lotions are worse than useless, as they injure the ear as an acoustic organ, because they "astringe the tympanic end of the Eustachian tube," prevent the expulsion of discharge from the tympanum through the perforation, and permit it to collect and become inspissated. They also cause cicatrization of the edges of the perforation, and interfere, therefore, with the process of repair of the hole in the membrane.

The treatment must consist in scrupulous cleanliness of the middle and external ear, the use of vegetable astringents, and the exclusion of air. This

forms the routine treatment under which recent perforations are most likely to heal. The same will apply to recent perforations in adults.

Perforations of long standing and with copious purulent discharge, improve under the use of alcohol instillations of various dilutions. In perforations of small size alcohol generally proves irritating and painful. It is claimed by our author that boric acid and iodoform, though usually acting well, sometimes, in chronic perforations, cause pain in the same side of the head. Our experience with iodoform is limited in comparison with our experience in the use of boric acid; but as both are known to have local anæsthetic properties, it is difficult to see how their use in the ear can cause pain in it, or in the corresponding side of the head. As a matter of fact, we have never seen any such results from their use in the ear, if they are simply insufflated. If they are blown in and then packed down into the fundus of the auditory canal, as is the manner of some, irritation is very apt to ensue.

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### Therapeutic Effect of Iodol in Suppuration of the Ear.

According to Schmidt, iodol possesses the advantage over iodoform in being inodorous, less irritant, and in not exciting any toxic symptoms from its employment on wounds. Dr. Stetler, of Königsberg, Russia (*Archiv für Ohrenh.*, Bd. 23, pp. 264–268), has endeavored to substitute iodol for iodoform in the treatment of diseases of the ear, especially in purulent otitis. It has been applied by him by insufflation, after a careful cleansing of the auditory canal, once or twice a day, according to the abundance of the discharge from the ear. The results of his experiments show that iodol has much the same action as iodoform. In the clinic of Schwartze, at Halle, iodol has been tried also. In the same number of the *Archiv f. Ohrenheilkunde*, there is a report of the results obtained there. Iodol being but slightly soluble in water, it has been used according to the plan of Mazzoni, viz., two grammes are dissolved in a mixture of sixteen parts of alcohol and thirty-four parts of glycerine. It has been used chiefly in otorrhœa complicated by caries of the bone. Compresses of gauze, dipped in the above solution, were placed upon the diseased bone, after cleansing, once or twice daily. The results were favorable; both the odor and discharge diminished. The formation of healthy granulations was not hastened by its use. On the whole, it does not seem that iodol has much of a future in otology.

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### Tinnitus Aurium, and its Treatment by a New Method of Alternate Injection and Evacuation of Air.

Admitting that we know of no specific for the cure of tinnitus aurium, Dr. John Ward Cousins maintains that the removal of this symptom must depend wholly upon the successful treatment of the special morbid process by which it is excited (*British Med. Journal*, March 26, 1887).

In speaking of the treatment of tinnitus dependent upon disease of the middle ear, he says "that theoretically the treatment of this form of tinnitus is a very easy matter, and simply consists in promoting free and healthy communication between the tympanum and the pharynx, and so restoring the normal balance of pressure on both sides of the membrana tympani." Pent-up fluids must be removed, and the mucous membrane stimulated to healthy

action. If collapse of the membrana and immobility of the bones exist, our efforts must be directed to promote the normal elasticity of these parts, and reëstablish their intrinsic movements. If the Eustachian tubes are obstructed by secretion, our remedies must be employed for the purpose of clearing the canals, and restoring the normal condition of the nasopharynx and throat.

In the early stages the use of the simple air douche will render good service, but in chronic cases Dr. Cousins prefers "the injection of air and its immediate evacuation. Sometimes the air is medicated by the vapor of some volatile substance, for the purpose of reducing the sensibility of the cavity and stimulating the mucous surface." To accomplish this purpose, an apparatus of his own invention is employed. It consists of two parts: 1. A special nasal piece, for hermetically closing the nose; 2. Two powerful hand-balls, which are connected with the former by an India-rubber tube. The nasal piece is composed of two tubes, with their extremities inclosed in inflatable bags made of very thin and soft rubber. The inflating tube has a separate connection with the lower part of each bag. The hand-balls are fitted with recoil springs, which impart force and rapidity to their expansion. One hand-ball is marked for injection, the other for evacuation, and their converse action is obtained by simply reversing the valvular arrangement, so that the outlet valve is fixed to the connecting tube on one side and the inlet valve on the other. The air injected may be medicated by dropping some selected fluid on cotton placed in a conical vulcanite receptacle at the distal end of the injecting tube. The alternate method of inflation is claimed by its author to have many advantages over the ordinary methods of inflation. Sometimes relief is given by one operation—as it is, indeed, sometimes by any method—while numerous operations may be required before relief is obtained in other cases. It is asserted that this method promotes the immediate discharge of pent-up secretion in the pharynx, and aids in establishing the drainage of the tympanum. "In chronic cases the mobility of the bony chain has been long impaired by the morbid condition of the middle ear; but by gentle repeated agitation in both directions, the adhesions between the ossicles are loosened, and their normal oscillation restored, so that sonorous vibrations can be again transmitted from the drum to the fluid within the labyrinth."

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### Abscess in the Brain resulting from Disease of the Ear.

Dr. Thomas Barr, of Glasgow, has contributed a most interesting and valuable article on this topic, in the *British Medical Journal* of April 2, 1887.

It is admitted at the outset that where abscess of the brain is not caused by an injury, it depends usually upon some preëxisting purulent centre, and this is most frequently in the ear. This is most usually in the middle ear, and it is held that the published accounts of internal ear inflammation, as the source of cerebral abscess, are erroneous. The nature of this disease is a chronic purulent inflammation in the lining membrane of the tympanic cavity, mastoid antrum, and mastoid cells. While there is a general consensus of opinion that ear-disease is the most frequent cause of cerebral abscess, Dr. Barr tries to show, successfully we think, that it is more frequently the cause than is even supposed. In a synoptical record of 76 cases (Sir William Gull and Dr.

Sutton, in Reynolds's *System of Medicine*, 1872), 27 cases, or more than one-third, were set down as due to ear disease. Lebest (*Virchow's Archiv*, 1856, vol. x.) gives 1 in 4 as the proportion, based upon 80 cases of cerebral abscess. But in many cases not attributed to the ear, given by these authors, Barr claims that the ear evidently had not been examined, "while in a goodly number the disease was said to have originated in a blow, which may be quite compatible with its real origin in ear disease." In 10 of the cases in the article in Reynolds's *System of Medicine*, no reason is given for the cerebral abscess. "We know that up to the time at which these articles were prepared, the hearing organ was very little examined, either in the clinical wards or in the post-mortem room." Coupled with the fact that purulent disease in the ear may exist without the knowledge of the friends of the patient, or of even the patient himself, Dr. Barr believes we are not in a position to state that 47 cases in these 156 of cerebral abscess are all that were due to chronic purulent disease of the ear. He thinks that from what is now known, that fully one-half of all cases of cerebral abscess are due to purulent disease of the ear. "As medical men come to use the ear-speculum in every case presenting symptoms of cerebral disturbance, the frequency with which ear disease leads to a fatal issue will be found to be greater than has hitherto been suspected."

The most frequent situation of the abscess seems to be in the temporo-sphenoidal lobe of the cerebrum. In 76 cases tabulated by Dr. Barr, 55 cases, or 73 per cent., were in the so-called middle lobe of the brain; 13 were in the cerebellum; in the cerebrum and cerebellum, 4; in the pons Varolii, 2; and in the crus cerebelli, 1. The disease is propagated from the ear to the interior of the cranium by two ways: 1. Most frequently by the roof of the tympanum and mastoid antrum; 2. By the inner wall of the antrum and mastoid cells to the dura mater lining the posterior fossa, and to the cerebellum. In some rare instances pus makes its way from a cerebral abscess into the middle ear, probably through the tegmen tympani. The "otorrhœa cerebralis," however, of ancient writers cannot be accepted, since the ear disease and not the cerebral disease is the primary affection. Opening the cranial wall by means of chiselling is regarded as productive of concussion to a brain already very sensitive by disease.

"It is quite clear that, in the future, persons suffering from abscess of the brain dependent upon ear disease should not be left to die as they have been in the past, without an effort being made, by opening the interior of the cranium, to reach the brain and drain the abscess. How this can be best done cannot be fully settled until further experience has been gained."

The concluding remark as to prevention is worthy of attention. "When every member of our profession is sufficiently impressed with the importance of chronic suppurative inflammation of the middle ear, and prepared efficiently to treat this disease in all its stages, the occasion for this operation will probably seldom arise."

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### A Case of Abscess of the Temporo-sphenoidal Lobe of the Brain, due to Otitis Media, successfully Treated by Trephining and Drainage.

The above named case occurred in University College Hospital, under the care of Dr. W. R. Gowers, and to which he called Mr. Arthur E. Baker, F.R.C.S., for surgical aid. (*British Medical Journal*, Dec. 11, 1886.)

The patient was a man nineteen years old. In all respects his health had been good until 1875, when he had scarlatina, which left him with a discharge of thin, yellowish fluid from the right ear. In August last (1886) he suddenly began to feel unwell and complained of pain behind and around the right ear. In the course of ten days he took to his bed, his temperature running up to 105° F. The next day the temperature fell to 103° F., then to 99.4° F., without constipation or diarrhœa. At the time of his admission to the hospital there was no impairment of the nervous system. There was, however, double optic neuritis, slight, but unequivocal. The hearing, taste, and smell are said to have been normal. [The hearing in the right ear must have been somewhat affected after a chronic disease of over ten years.—Reporter.] There was a fetid discharge from the right ear. Urine healthy. Evening temperature 101° F. The next day temperature as low as 96° F. and pulse 52. On the fifth day after admission, Mr. Barker examined the ear and found a large perforation in the right membrana tympani, in the anterior and upper segment. The middle ear was filled with a thick, fetid purulent débris. There was no sign of acute inflammation or tenderness about the ear, or mastoid region.

From the morning of the sixth day after admission, the temperature fell steadily to 97.6° F., on the morning of the eighth day. It varied then between this and 98.8° for a week more. The optic neuritis increased, and the patient grew dull. He had severe vomiting without previous nausea, and his temperature sank to 97.6° F. His pupils were now observed to be unequal, the right being more contracted and sluggish than the left. No headache and no squint. The optic neuritis more marked. On September 27th, twelve days after admission to the hospital, the symptoms were more aggravated, but the temperature remained 98° F. throughout the day. The next day, Mr. Barker decided to open the mastoid antrum and middle ear and search for pus in the latter, and wash it out and drain it, if pus were present. "This was done in the usual way with a gouge, at a point about half an inch above and behind the centre of the external auditory meatus. On opening the antrum there was no gush of pus, but some came away on the instrument; on injecting the meatus, a quantity of curdy and very fetid material was forced out of the opening in the bone; and on inserting a syringe into the latter, similar matter welled out of the meatus. Having then thoroughly washed out the middle ear with carbolic lotion, the whole area of operation was dusted with iodoform and dressed with salicylic wool, a drainage tube being left in the opening."

The next day the patient was decidedly better, though still slightly drowsy; the right pupil did not dilate as fully as the left. Temperature 98.4° to 99° F. Wound dressed with boric acid fomentations, and drained well. The next day the patient felt better and was brighter. There was no pain. "The pupils, however, remained the same, and the optic neuritis was steadily increasing." Temperature 98.6° F.

On the third day after the operation a silver drainage tube was substituted for the rubber one, in the mastoid opening. On the next day, the patient was not so well, having had a restless night. There was no pain, but the patient vomited in the morning. Bowels confined; drowsy. Temperature 98.8° to 97.8° F. On the third day the patient was still drowsier, having been slightly

delirious during the previous night. He also vomited, but had neither headache nor squint. On the fourth day he felt drowsy, and on the next day more so. Temperature was normal. While the ear was being syringed there was well-marked nystagmus to the left, in both eyes, which ceased immediately on discontinuance of syringing. In the evening the temperature rose to 105° F., and the patient had a rigor lasting forty-five minutes. The rigor and the intense optic neuritis, in connection with the negative result of the previous exploration, were held to indicate the presence of a cerebral abscess, and Mr. Barker was asked to trephine and search for one in the temporo-sphenoidal lobe. This was done on the same evening. In the first place, the auditory canal, the mastoid wound, and the middle ear were washed out with a solution of carbolic acid (1 to 20) and then dusted with iodoform. A V-shaped incision was made by joining the incision previously made over the mastoid by one running from behind and above, downward and forward. Beneath this flap the bone was found to be healthy. A spot was then chosen for the pin of the trephine, an inch and a quarter behind, and an inch and a quarter above the centre of the meatus of the auditory canal. The region of the foramen of the mastoid vein was thoroughly examined and found normal. This point is always examined by Mr. Barker before opening the skull in cases of intracranial suppuration, because it is claimed that "if there be inflammation on the posterior aspect of the petrous bone, it can hardly reach the cerebellum without forming a layer of pus under the dura mater of the lateral sinus. If this is so, the pus will escape by the mastoid foramen, if the latter be exposed."

The trephine was then used at a point corresponding to the inferior posterior angle of the parietal bone, close to the squamosal suture. The dura mater was found to be quite normal. The membrane was then divided with a knife and turned back, when the surface of the brain was seen to be unaffected, nor was there any fluid in the arachnoid space.

The whole wound and the opening made by the trephine having been again thoroughly washed by a strong solution of carbolic acid and dusted with iodoform, Mr. Barker thrust a hollow aspirator-needle, about the size of a No. 4 catheter, into the temporo-sphenoidal lobe, in a direction inward, forward, and downward. This was done slowly, and when the point had reached a spot about half an inch inward from the surface of the brain, a bubbling sound was heard, followed by thick, yellow, intensely fetid pus, to the extent of four and a half drachms. No more pus escaping through the needle, the cortical wound was slightly dilated, and two or three drachms of pus escaped. The entire area of the wound was then washed and dusted with iodoform, as before, and a rubber drainage tube, two inches long, also dusted with iodoform, was inserted for an inch of its length into the abscess. The V-shaped flap was cut away at its base, so as to leave the trephine hole free for drainage. In a fortnight after the operation, the drainage tube was left out of the wound and the patient allowed to get up. On the third day after the operation a silver tube was substituted for the rubber tube, the latter not staying well in place. The optic neuritis was now greatly improved and disappeared entirely in about three or four weeks after the operation.

In thirty-eight days after the trephining (Nov. 25th), the patient left the hospital looking and feeling very well. There was still some purulent discharge from the affected ear.

By December 4, a month later, both wounds behind the ear had healed, and there was only a slight moisture in the fundus of the right ear. There are other data contained in this article most worthy of perusal by those further interested in such an operation.

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### On the Surgical Treatment of Brain Suppuration following Ear Disease.

In an article with this title, "the brain-complications which, while possible with an intact membrana tympani, are commonly associated with long-continued purulent discharges from the middle ear, with generally mastoid involvement," are considered by Dr. R. F. Weir, in the New York *Medical Record* of April 9, 1887. In a case of chronic purulent disease of the ear, in a woman, thirty-nine years old, in which the mastoid was operated on, the subsequent cerebral symptoms pointed toward an abscess in the brain. Therefore, the original mastoid perforation was enlarged for half an inch (it had been made just where the mastoid glides into the external canal), and deepened, until the dura mater was exposed nearly the size of a finger nail. Cutting through this membrane, a hypodermatic needle was introduced to a depth of nearly an inch and a half, being directed along the upper part of the petrous bone, and also into the cerebral lobe in this region, but nothing but a little blood was extracted. No result was obtained by this operation. Eleven days afterward the patient became hemiplegic on the side of the affected ear, with a temperature of 103°, an irregular pulse of 68, and there was vomiting. Under these discouraging circumstances a further ineffectual attempt was made to relieve the patient. With a one-inch trephine a button of bone was removed over the left Rolanderic line, and the dura mater incised crucially, and about two ounces of clear cerebro-spinal fluid were let out. Six exploratory punctures were then made with an aspirator, but nothing was detected. The patient was not bettered, but died next day, comatose. An autopsy was refused.

Dr. Weir states that the situation of an abscess in the brain depends to some extent upon the route by which the inflammation extends from the ear cavities, "the condition of long-tarrying pus, however, being by far the most important of all factors in the self-infection." The important surgical fact, however, comes out strongly, from numerous observations of others, that a majority of the purulent depots in the brain from ear disease are encountered in the temporo-sphenoidal lobe, and that after this the most affected locality is the cerebellum. It should also be borne in mind that both of these regions are fortunately of less value to life, and can better tolerate surgical interference, than almost any other portions of the brain. "It is to the fact of their slight motor importance that our power of localizing tumors and abscesses in these regions is so poor, and this consideration leads directly to the remark that the earliest decided evidences of brain-pressure in the disease under question should be acted upon as soon as detected, since their development presupposes an already large accumulation of pus." Surgical interference with the brain is therefore advised, as soon as a mastoid operation has shown itself to be impotent to relieve the symptoms. In this connection it is well to recall the fact that one-fifth of the cases of cerebral abscess die unrelieved by the mastoid operation. The relief sometimes observed after a mastoid

operation, either with or without finding pus, is explained by the supposition that either the cerebral abscess itself has been drained by the operation, or, what is more likely, that an extra-dural collection of matter has been let out by the mastoid opening. In view of these considerations, Dr. Weir believes that, anatomically and surgically, no reasons exist adverse to an early opening of the dura and draining the fossa in cases of suppurative meningitis of the middle fossa due to aural disease. When symptoms are present by which the probable site of the purulent collection can be located, whether in the temporo-sphenoidal lobe or in the cerebellum, the surgeon will be guided largely by the neurologist. The cerebellar region is not regarded as inaccessible to surgical treatment, and therefore the advice is given that if the cerebral abscess can be excluded in favor of an abscess in the cerebellum, there should be no hesitation in operating below the tentorium through the occiput. The guide in operating on the cerebellum, given by Mr. Barker,[1] should be remembered, viz., to expose the opening of the mastoid vein, where, if pus has spread backward to the cerebellum from the ear, some of the discharge will be found oozing from beneath the dura, at this opening in the masto-occipital region. Much of a minute and specific nature is given in this paper by Dr. Weir, and should be carefully read by all contemplating an operation for the relief of an abscess in the brain.

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## DISEASES OF THE LARYNX AND CONTIGUOUS STRUCTURES.

UNDER THE CHARGE OF

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### Diphtheria.

To favor syringing the nasal passages, Reierson, of Copenhagen, passes medicated bougies which melt in an hour, and reëstablish the patency of the passage. For large children and adults they are 3½ inches in length and ⅛th of an inch in diameter. The formula is cocaine hydrochlorate ⅛–¼th grain, boric acid 15 grains, starch and powdered acacia each 1½ grains, and glycerine sufficient. For younger children the bougies are shorter, and contain ½ grain of the cocaine, or less, and 10 grains of the boric acid. The bougies should be stiff, and be pointed at one end. One is introduced into each inferior meatus. They should reach as far as the nasopharynx.—*Journal of Laryngology*, Jan. 1887.

### Intubation of the Larynx.

Dr. A. Caillé, of New York, reports (*Medical Record*, March 19, 1887) a successful case in a child five years of age, with diphtheritic laryngeal

[1] Alluded to already in this report.

stenosis. Attention is called to a Dr. Denhard's important modification of the gag, but this is not described.

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### Early Tracheotomy in Diphtheria.

Mr. W. Watson Cheyne (*Brit. Med. Journ.*, March 5, 1887) believes that the indication ought not to be obstruction to the respiration, but that tracheotomy ought to be performed in cases of diphtheria as soon as it is certain that the larynx is affected; and chiefly with the view of preventing the spread of the membrane downward. This he claims to do by inspecting the incised trachea, removing any semblance of membrane if present, and, membrane or no membrane, applying a 1 in 500 solution of bichloride of mercury.

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### Lupus of the Nose and Rhinoliths.

Dr. L. V. Silitch, of St. Petersburg (*Vratch*, No. 1, 1887), reports two instances of calculi removed from patients with lupus of the nose.

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### Mucous Polypi in the Right Antrum.

Dr. Shaeffer (*Monatschrift für Ohrenheilkunde*, etc., 1886, No. 11) describes an instance in a female, fifty-nine years of age, for sixteen years the subject of nasal polypi. Eight or ten dense, small polypi were removed by scraping the antrum with a sharp spoon, access being through the socket of the second molar. At the date of the report severe neuralgic pains, supraorbital, infraorbital, and alveolar, had continued relieved for four months.

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### Cyst of the Nasal Mucous Membrane.

Schaeffer (*Monats. f. Ohrenheil.*, 1886, No. 11) reports a cyst the size of a walnut, involving the anterior portion of the lower right turbinate body and the floor of the nose of a woman, fifty-four years of age. It was opened by a large incision made upward behind the upper lip, and discharged a tablespoonful of albuminous fluid, with a few flakes of pus. The cavity was cauterized with chromic acid, and a drainage tube inserted. Contraction of the cavity necessitated removal of the tube the next day. Recovery was complete in eight days.

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### Nasal and Nasopharyngeal Reflex Neuroses.

Dr. P. McBride, of Edinburgh, in a lecture reported in *The British Medical Journal* of January 29, 1887, traces the recent history of the literature on this subject, coming, among other conclusions, to the following: That application of the actual cautery to the nasopharyngeal mucosa is no less effective than cauterization of other parts which has been known to cure such neuroses, and may be more so; that we have no means of knowing, in any given case, whether it can be cured by treatment to the nose; that weakness of voice accompanying granular pharyngitis may be purely reflex, and that electricity to the larynx may be indicated rather than destruction of the granulations. A tolerably complete bibliographic index is appended.

### Stricture of the Œsophagus.

In a female forty-nine years of age, whose symptoms had been those of chronic gastritis with emesis, the œsophagus, for nearly its entire length, was found by Dr. J. W. Roosevelt, dilated to about the bulk of a quart. (*Medical Record*, March 12, 1887.)

In an article on the treatment of malignant stricture of the œsophagus by tubage or permanent catheterism, by Mr. Charter J. Symonds (*Brit. Med. Journ.*, April 23, 1887), he reports four personal observations, having had eight cases under prolonged treatment. He prefers dilatation with bougies so long as solids can be swallowed; then the use of a short rubber tube, removed from time to time, until fluids can no longer be taken; and then resort to Krishaber's long tube, or to gastrostomy.

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### Pulsating Arteries of the Pharynx.

Dr. J. W. Farlow, of Boston, presents (*Journal Amer. Med. Assoc.*, April 2, 1887) a record of five cases of large visible pulsating artery on the posterior wall of the pharynx, with remarks. All five were in females, the ages being four, thirteen, eighteen, twenty-three, and thirty years.

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### Laryngectomy.

Mr. Lennox Browne, of London, has reported (*Brit. Med. Times*, February 5, 1887) a successful case of partial excision of the larynx, on account of intra-laryngeal epithelioma in a man sixty-one years of age. One-half of the larynx was removed.

Dr. D. Hayes Agnew, of Philadelphia, reports (*Med. News*, April 9, 1887) a case of total extirpation for epithelioma. Death ensued on the second day from exhaustion.

Extirpation of the larynx for carcinoma was performed by Dr. J. H. Branham, of Baltimore, on January 20th (*Maryland Med. Journal*, February 5, 1887, p. 356). Death ensued within thirty-six hours from "aspirating" pneumonia. In this case, as in Agnew's, unsuspected infiltration of the œsophagus was revealed during the operation.

Dr. W. Gardner, of Aldelaide, South Australia, reports (*Lancet*, May 7, 1887) a case of excision of the epitheliomatous larynx in a male, aged sixty. Three months later the disease had reappeared.

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### Fibrosarcoma of the Nasal Septum.

MM. Calmettes and Chatellier report (*Annales des maladies de l'oreille du larynx*, etc., Mars, 1887) a case in a married woman, thirty years of age, successfully removed by operation with the incandescent electric loop. Eleven months later there had been no recurrence.

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### Black Tongue.

Dr. Ph. Shech, of Munich (*Münchener med. Woch.*, No. 13, 1887), reports a case in which he examined microscopically a portion of the product cut as

close to the base as possible. He found it composed of excessively elongated, pigmented, and fully cornified filiform papillæ, but failed to find the special mycophites described by some observers. He concludes that the black tongue belongs to the category of hypertrophic, and not of mycotic, diseases.

### Pharyngitis Sicca.

Dr. E. J. Moure, of Bordeaux, recommends (*Revue mensuelle de laryngologie*, etc., Avril, 1887), among other treatments, pencillings with a mixture of tincture of capsicum, one part in fifty to one hundred of glycerine.

### Laryngeal Measurements.

Dr. Moura, of Paris, concludes in the April number of the *Revue mensuelle de laryngologie*, etc., his exhaustive and laborious series of measurements of the various laryngeal structures in males and females in his critical studies of the anatomico-physiological conditions of the human voice. A series of tables presents the statistical records of the observations described at length in the text.

### Atrophic Rhinitis.

Dr. Noquet, of Lille, in some considerations on this theme (*Revue mens. de lareto*, Mai, 1887), claims to cure the disease in many instances, even to regeneration of the atrophied tissues. He uses Weber's douche twice a day, with a tablespoonful of potassium chlorate to the litre of tepid water, followed by pulverization of a solution composed of chloral hydrate, 1 part; boric acid, 12; glycerine, 20; distilled cherry-laurel water, 40; and distilled water, 400 parts. In the middle of the day an additional pulverization is practised with water aromatized with antiseptic vinegar, in the proportion of about one to fifty. After eight days carbolic acid replaces the potassium chloride, in the proportion of about two grammes to the litre. In addition, pencillings are made by the attendant with a solution of zinc chloride (20 : 100?), rendered limpid by the addition of a small quantity of chlorohydric acid.

## DERMATOLOGY.

UNDER THE CHARGE OF

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AND

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### Ichthyol.

Elliot contributes (*Medical Record*, March 19, 1887) a comprehensive paper on his experience with ichthyol in the treatment of cutaneous diseases. He finds that the two ichthyol preparations—ammonium ichthyol and natrium

ichthyol—differ in their action, often considerably. As a rule, better results are to be obtained by the soda preparation. In cases of simple acne, acute or subacute in type, the natrium compound was without result. It was given internally in doses of four to eight grains three times daily; the ammonium compound gave the same negative results. In acne indurata the natrium ichthyol was also useless, but the ammonium preparation rendered good service. It was applied as a five to eight per cent. solution. Deep-seated, indolent, lumpy lesions were arrested in their development and rapidly disappeared. In spite of its prolonged use and administration, however, new lesions continued to make their appearance. It proved valuable, also, in those cases of acne of the chin in women, usually so obstinate to treatment.

In the treatment of rosacea the results were unsatisfactory. In some cases of eczema its local application appeared useful, but the internal administration of the remedy had no apparent effect, either on the immediate attack or in preventing relapses. In chronic eczema rubrum, especially when on the legs, and depending upon varicose veins, excellent results were obtained by the use of the natrium ichthyol; the ammonium preparation, even in weak percentages, gave rise to pain, burning, and an increase in the inflammatory symptoms. More especially were the favorable effects of the soda compound (three to five per cent. aqueous solution) seen in its keratoplastic action, in this class of cases associated with ulcerations. In seborrhœa oleosa about the nose, the ammonium compound gave good results, if used alternately with other plans of treatment. In intertrigo the natrium ichthyol proved serviceable; the ammonium salt was less valuable. It was used in ointment form, two to ten per cent. strength.

In dermatitis these preparations were also useful. The same good effects in burns of the first and second degree were seen to follow applications of a five per cent. aqueous solution of the natrium salt. In chronic urticaria the administration of the ichthyol salts seemed without value. The same may be said as regards ichthyosis, used both externally and internally. In the after-treatment of lupus, following the use of the nitrate of silver or the curette, an ointment of the natrium compound, five per cent. strength, induced rapid healing. The effect of a five per cent. ointment of the ammonium ichthyol on cicatrices was of a satisfactory character; the parts were rendered more pliable, and also a decrease in size often following.

While admitting the value of the ichthyol preparations in certain diseases of the skin, the author, from his experience, cannot consider them entitled to the therapeutic importance claimed by Unna, Küssner, and other German observers.

UNNA, in a brief note in the *British Medical Journal* of April 9, 1887, reaffirms his opinion as to the value of ichthyol, administered internally, in acne rosacea, nervous forms of eczema in persons of nervous constitution, eczema from teething, lichen urticatus, erythema multiforme, dermatitis herpetiformis, and furunculosis. It is not indicated in psoriasis. After five years' experience with the remedy, Unna states that it is also valuable in acute and chronic rheumatism, bronchial asthma, chronic catarrh of the stomach and intestines, together with catarrh of bile duct (icterus), chlorosis, tuberculosis (especially in children), scrofula, and in vascular engorgements of all kinds. [The dose of ichthyol varies from three to fifteen grains three times daily, preferably administered in capsules.—EDS.]

### Amenorrhœa, Septicæmia, and Dermatitis Multiformis.

Dr. H. F. Kerr (*Virginia Med. Monthly*, January, 1887) reports a case of amenorrhœa, followed by septicæmia, a multiform dermatitis, and death, occurring in a previously healthy girl seventeen years of age. A cold was contracted, the result of dancing and over-heating, after which menstruation ceased, and various general symptoms set in. Three months later, swelling, having a purpuric aspect, occurred about the face, hands, forearms, and feet, followed soon by numerous distended blebs of the size of large split peas, round and oval in form, containing a clear fluid. Intermingled with the blebs were small, pin-head sized pustules, containing pus of a whitish color. There were itching and burning. In a few days the blebs became covered with yellowish, and later, brownish crusts. The face and forearms were the seat of a thick, adherent mass of crusting, beneath which the skin showed an oily, smegma-like, cheesy product, which, when removed, displayed a bluish sensitive skin. In other regions, as the neck and elbows, the crusts were soft and fatty, and there existed deep and painful fissures. On the flexor surfaces of the arms, hands, and feet, especially, and to some extent over the whole surface, the skin had the consistence and appearance of old leather, being thickened and sclerosed. Later, desquamation occurred in the form of exfoliation, the skin of the fingers and toes coming off like casts. In certain regions, as on the body and the legs, the eruption manifested a squamous type. The temperature and pulse were both above normal. The treatment was expectant. The patient died. Two weeks before death a whitish, jelly-like, odorless discharge took place from the vagina. Previous to this, an examination of the uterus gave no cause for the menstrual suppression.

Dr. Kerr is of the opinion that septicæmia existed as the result of suppression of the menses and absorption of septic matter, and that the cutaneous symptoms, although different in some respects, bear more relation to Duhring's dermatitis herpetiformis than to any other disease.

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### Impetigo Herpetiformis.

Kaposi (*Viertelj. für Derm. u. Syph.*, 2 Heft, 1 Hälfte, 1887) is of the opinion that the term impetigo herpetiformis, proposed and employed by Hebra, in 1872, to define a rare and peculiar disease of the skin, should be retained for this affection, of which he has seen thirteen examples. Hebra's observations led him to think that the disease was peculiar to women, and who were either pregnant or were in the puerperal state, a view which has likewise been entertained by Kaposi until now. He has recently seen a case occurring in a man. All of the cases, except one, proved fatal. The paper is illustrated with four handsome chromo-lithographs, several of which are reproductions from Hebra's atlas. The author regards some of the reported cases of impetigo herpetiformis (as those of Heitzman and of Pataky) as examples rather of pemphigus and herpes iris, than of the disease under consideration. He also takes exception to viewing impetigo herpetiformis as a variety of dermatitis herpetiformis, as proposed by Duhring.

Impetigo, it is stated, signifies pustules—that is, efflorescences filled with pus; while herpetiformis, as this term was originally employed by Hebra,

conveys merely the idea that the lesions are arranged as in "herpes"—that is, in groups and streaks or bands (streifen), and that the eruption, just as in "herpes," spreads peripherally after undergoing central involution. It would have been better, perhaps, the author thinks, to designate the disease "impetigo circinata et iris," in which case the term herpes would not have appeared in connection with this subject. Herpes has nothing in common with impetigo, the former being defined as an acute affection characterized by *vesicles* (*i. e.*, efflorescences filled with clear, translucent serum), which only in the course of hours or days became cloudy or pustular, together with the appearance of other signs of involution. In impetigo there exist from the beginning pustular vesicles (*eiterhältige Bläschen*), and always only such during the entire course of the disease.

Impetigo herpetiformis is characterized, 1st, by miliary, existing primarily as such, superficial—*i. e.*, *epidermoidal*—pustules; 2d, these, throughout their entire course, manifest the same features; 3d, they are always arranged in groups and aggregations; and, 4th, the lesions appear afresh on the border of older patches, in the form of one or more series, upon inflamed bases, while in the centre involution occurs, but in no case ulceration and scarring. Other essential characters of the disease are found in the exclusive occurrence in pregnant or puerperal women [the case of the author, occurring in a man, is reported later in the article.—EDS.]; the accompanying chills and marked fever; preference of the eruption for certain localities, as the genito-crural region, mammæ, and mucous membrane of the mouth; and finally, with one exception, the fatal termination of the disease. The author inclines to the view of the process being pyæmic.

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### TWO EPIDEMICS OF MOLLUSCUM CONTAGIOSUM.

DR. W. F. MITTENDORF, of New York (*Trans. Amer. Oph. Soc.*, 1886), thinks, from his observations in two epidemics of this affection, that there is very little doubt in regard to its contagiousness. The disease occurred in two distinct homes for children on Staten Island. A little girl was admitted to one institution with one or two small "warts" on the eyelids: within a few weeks several of the other girls had the same growths appear on the eyelids, lips, and nose. Three months after the admission of the first case, twenty-seven children, nearly all of them girls, were affected, the lesions in every instance involving the eyelids, and in some other parts of the face, but in no case was the rest of the body invaded.

In the other institution the first case was observed two years ago, and at date of writing, forty-one children were affected, as well as one of the nurses and her child, who lived outside of the nursery. Some of the children were given out to a farmer who boarded them. In a short time the disease had spread to several of the children boarding at this farmer's place, to the child of the farmer, and likewise to his wife, disfiguring her greatly. In a number of instances the tumors, varying in size from a mustard seed to that of a pea, had spread to other parts of the face, but they were usually confined to or more marked about the lids, some being located at the free edge of the lid and among the eyelashes. Three cases of spontaneous cure were noted.

In regard to the treatment, it was found that abscission with curved scissors and touching the base with stick of nitrate of silver was most satisfactory.

### Merck's Concentrated Lactic Acid; Some of its Uses in Dermatology.

In the *Journal of Cutaneous and Genito-Urinary Diseases* (April, 1887) Knoche relates his experience with lactic acid in the treatment of tylosis, chloasma, freckles, and warts. In tylosis the acid was applied pure, being well rubbed in. The epidermic masses were soon softened, and easily peeled off, this result following a few days' treatment. The affection tended to recur, but finally, under this treatment, disappeared. In a case of chloasma, the acid was applied diluted with three parts of water; after the second application the surface became slightly inflamed. The inflammation soon subsided, and the epidermis began to peel off in spots. Upon a repetition of the treatment the discoloration was entirely removed. A case of freckles was treated in the same manner with satisfactory results. In the treatment of warts also the author had success; the free acid was applied, by means of a pointed stick, two or three times daily for several days.

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### The Cutaneous Punch.

Keyes describes (*Journal of Cutaneous and Genito-Urinary Diseases*, March, 1887) a small punch or trephine which he has employed with success in the removal of powder specks from the skin, in epithelioma, moles, and other blemishes. The instrument is made in several sizes, and has a sharp cutting edge. By pressing it upon the skin and rapidly rotating, a circular piece of skin, corresponding to the size of the instrument used, is cut; this projects, and is snipped off with the scissors. The depth of the cut may be varied according to the amount of pressure made. As an after-dressing the author used chiefly powdered subsulphate of iron. In cases in which the smallest sized punch was used the scarring was scarcely perceptible.

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### Actinomycosis of the Skin.

Majacchi (*Monatshefte für prak. Derm.*, No. 7, 1887) was the first to describe a case of actinomycosis of the skin, occurring in a young woman, in 1882 (Rivista clin. di Bologna). A second case is now reported by this observer, in the person of a child, seven years old, the disease being in the neck in the form of two ulcers with scrofulous aspect. Between the granulations were found numerous sulphur-yellow masses, some of which were hard and chalky, and could be readily removed without pain or causing bleeding. Microscopic examination showed a large number of actinomyces surrounded by young granulation tissue. Under the use of mercurial ointment, and later iodoform, the wounds healed in about six weeks, without a return of the disease. The case observed in 1882, manifested itself in an anthracoid form with purulent necrotic products, together with pyogenic microörganisms in addition to the actinomyces, causing septicæmia and the death of the individual.

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### Dermatitis Venenata.

Dr. J. S. Howe (*Bost. Med. and Surg. Journ.*, March 10, 1887) calls attention to the poisonous effects upon the skin of leucanthemum vulgare, known

in different localities as white daisy or field daisy, which is plentiful in New England and in the middle Atlantic States. Four cases of severe dermatitis are detailed, the eruption closely resembling in character that resulting from rhus, dogwood, and sumach. It would seem that the inflammation is particularly liable to attack those who are subject to dermatitis from rhus, etc.

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### Chronic Zoster.

Dr. Leudet (*Archives Gén. de Méd.*, January, 1887) believes, with Verneuil, that zoster may present itself in several forms; thus, it may be acute, transitory, and without apparent gravity, leaving behind it pains of longer or shorter duration, and disappearing without leaving trace. Another time the eruption may persist over a period of months, and the ulceration which succeeds the vesicles may be deeper, or, after cicatrization sufficiently rapid, the scar may ulcerate anew, and the process repeat itself several times. Sometimes it is limited to the relapses of ulceration. At other times the ulceration is accompanied with redness, swelling, and a neuritic pseudo-phlegmon, as Hamilton has described. Finally, the ulceration may cicatrize and give place to keloid, which may be regarded as a truly chronic zoster.

A second form is that which the author denominates "relapsing zoster *in situ*." A third form is characterized by successive extension upon several branches of the same nerve or upon contiguous nerves. Finally, the fourth form may be called "zoster at a distance," and in these cases the herpetic eruption spreads out upon one or another nerve distant or may be secondary to a lesion of a nerve filament, without apparent anatomical relation to that where the eruption manifests itself. This classification is similar to that put forth by Verneuil, who describes three forms of zoster: 1st. The peripheric or centrifugal; 2d. The traumatic in proximity; 3d. The traumatic at a distance.

Leudet's conclusions (based upon an experience of eighty-five cases, extending over thirty years) are summed up as follows:

1. Zoster, in medical diseases, as in traumatism, may be: *a*, the expression of a local lesion, manifesting itself upon the peripheric branches of an altered nerve; or, *b*, it may make its appearance at a distance in general diseases, calling forth the lesions on the peripheric nerves; or, *c*, it may be chronic *in situ*, relapsing successively upon the nerves and branches in direct anatomical communication with the primitive branch attacked, or upon distant branches; *d*, it may, moreover, be the effect of poisoning, as by carbonic oxide.

2. The anatomical cause is a lesion of the intervertebrate ganglia, of the Gasserian ganglion, and of the peripheric nerves, or of these latter only.

3. Local lesions of the pleura, of the lung, of the spinal column, of the spinal meninges, of the cord, of the brain, are such as have occasioned zoster in the classical observations of Bærensprung, Charcot and Cottard, Chandelux, and others. Chronic pleurisy and tuberculosis of the lung should figure among the most frequent causes of zoster (20 out of 86 cases).

4. Chronic zoster may persist three or even six months. The ulcerations which succeed the vesicles may reproduce themselves, and sometimes terminate in keloid. Each exacerbation of the ulceration may be accompanied with redness and swelling.

5. Frontal zoster may be called forth by an exacerbation of pulmonary tuberculosis, and by the paralytic or convulsive accidents which have been described in empyema.

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## MIDWIFERY AND GYNECOLOGY.

UNDER THE CHARGE OF

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### COMPLETE INVERSION OF THE PUERPERAL UTERUS: THREATENED GANGRENE, AND CURE BY LAPAROTOMY.

SCHMALFUSS records in the *Centralbl. für Gynäk.*, No. 46, 1886, a case of inversion of the uterus after labor. Partial gangrene of the uterine wall was present, and, therefore, abdominal section was performed as Thomas, of New York, has recommended, so that replacement might be brought about with as little force as possible. With careful antiseptic precautions the abdomen was opened and the funnel-shaped portion of the inverted uterus drawn up. The funnel was dilated with the finger and pressure made through the vagina on the fundus by means of a sponge on a sponge-holder. Reinversion was easily performed in this way, the uterus washed out with cold boracic lotion, and the vagina tamponed with iodoform gauze. Recovery was complete.

### DEFECTIVE SANITATION AS A CAUSE OF PUERPERAL DISEASE.

PLAYFAIR, in the *Lancet* of Feb. 5, 1887, draws attention to the fact that sewer gas may cause in puerperal patients attacks of illness indistinguishable clinically from ordinary puerperal septicæmia. The following illustrative cases were given:

*Case I.*—Temperature 104° for six weeks; pyæmic abscesses two months afterward. The defects in drainage were leaking of soil pipe, leaking brick drains, and defective joints with soaking of sewage. Further, the lady's bedroom, boudoir, and water-closet were continuous. The curious fact is further mentioned that in a favorite professional street in London there have been seven cases of puerperal septicæmia, with two deaths, in five years.

*Case II.*—Patient had dangerous septic disease, while her husband had also diphtheritic sore throat. The waste pipe of the bath-room, which was close to the bed, opened directly into the main drain, which was thus ventilated into the dressing-room.

*Case III.*—Lady had well-marked septic symptoms in her second confinement. On examination it was ultimately found that what seemed to be a wardrobe in the bedroom was really a water-closet; it had a special soil pipe carried through the centre of the house and opening directly into the main drain. It was really a costly means of ventilating the main drain into the sleeping apartment.

In all the cases removal from the infected house was followed by good results.

### Treatment in Cases of Abortion where the Placenta is Retained.

Budin, in a recent lecture delivered at the Academy of Medicine, considers the treatment in cases of abortion where the membranes have been retained; the dangers of such retention are hemorrhage and septicæmia. The ordinarily accepted treatment by immediate removal, either by the finger or curette, he criticises unfavorably, and then proceeds to discuss

1. *Is retention of the placenta really a source of frequent accident?*
2. *Are the digital and instrumental procedures for the removal of the placenta quite inoffensive?*

In 210 cases at the Charité and Maternité the placenta was retained in 46 cases (22 per cent.). When the abortion was complete the mortality was almost nil.

In the incomplete cases the results were good; one patient died from septicæmia. Budin quotes several cases of death or of cellulitis, peritonitis, and endometritis following active removal of the placenta, either manually or by the curette. He recommends, therefore, the vaginal antiseptic plug against serious hemorrhage, and vaginal, or, if necessary, uterine antiseptic douches when septic symptoms arise. The antiseptics recommended are corrosive sublimate 1 : 2000 or 1 : 3000, and carbolic acid 2 : 100 or 3 : 100.

[Budin is so careful and accurate an observer, and one so thoroughly imbued with the principles of antiseptics, that any recommendation from him is worthy of all attention. At the same time I cannot indorse his treatment. In many cases of retained placenta after abortion I have always removed the retained portions at once and douched the uterus with an antiseptic. Where the cervical canal has not been sufficiently dilated I have used Hegar's dilator to complete this. The retained portions can thus be removed bimanually as follows: The patient is chloroformed and placed in the dorsal posture. The right hand is then passed into the vagina and the index finger into the uterus, which is grasped by the left hand so as to steady and fix it. The finger can now easily separate bulky remains, and any shreds can be curetted out. I have never had any result but perfect recovery, with no inflammatory sequelæ.]

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### The Treatment of Umbilical Hernia.

Olshausen believes (*Arch. für Gynäk.*, Bd. xxix. Heft 3) that umbilical hernia is fatal unless operated on, despite the statistics of Lindfoles, who records twenty-seven cases of cure by pressure or the ligature. Olshausen, in fifteen cases, has seen no instances of preservation of life unless in operated cases. One child with part of the liver in the sac lived five weeks. When left to nature we usually get destruction of the amnion, tear of the peritoneum, and peritonitis, causing death. The following cases of operation are given:

*Case* 1 *by Breus.* In this case Breus opened the sac, replaced the hernial contents without difficulty, grasped the opening with forceps, and passed strong silk suture below the forceps. The sac was then cut away above the forceps and cauterized. Cure resulted.

*Case* 2 *by Felsenreich.* The sac was opened, excised, and the abdominal incision sutured by twelve stitches. Union by first intention.

The cases of Lindfoles and Stadfeldt we omit, and pass on to give the one recorded by Olshausen.

The child presented footling, weighed 4280 grammes, and was 57 cm. long. It had a large umbilical hernia and macroglossia. The cord was 96 cm. long, and was tied about 10 cm. from the umbilicus. The opening of the hernia was about 4 cm., and the sac contained intestine. Half an hour after birth there were bullæ and a slight tear of the sac. Three and a half hours afterward the following operation was performed: An oval incision was made close to the skin margin around the internal opening, and then the skin edge and amnion stripped off the parietal peritoneum (sac). The raw edges of the skin were then brought together, the cut vessels being ligatured. In this way the hernia was reduced with the peritoneum intact. The wound healed slowly but soundly. The child died eight months afterward from intestinal catarrh. On post-mortem, the macroglossia was found to be due to connective tissue hyperplasia. There was also non-descent of the ovaries.

Olshausen finally points out that this operation cannot be practised unless the hernia is replaceable.

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### A Case of Gastrotomy for Extrauterine Gestation in which the Placenta never came away.

Dr. Braithwaite records (*Lond. Obst. Trans.*, 1886) a case where he performed abdominal section for extrauterine gestation. The fœtus was full-grown, had been dead for three weeks, and was lying quite free in the abdominal cavity, except that a fine membrane cut it off from the intestines which lay above it. The placenta covered the top of the uterus, was not removed, and, so far as could be made out, did not come away afterward. When the patient was examined bimanually some time after the operation, no trace of it could be felt, unless as a small ring of dense tissue at the level of about half an inch from the fundus uteri.

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### Fœtus and Placenta of Extrauterine Gestation removed by Abdominal Section.

Dr. Herman describes (*Lond. Obst. Trans.*, 1886) a case where he removed an extrauterine fœtus by abdominal section. The fœtus lay enclosed and adherent to its membranes, the liquor amnii having been absorbed. The placenta was attached to the anterior abdominal wall, upper surface of bladder, and left broad ligament. Dr. Herman tied and divided muscular adhesions between placenta and omentum, and separated, by tearing, the placenta from the bladder and abdominal wall. The part of the placenta adherent to the broad ligament was treated by tying the latter in two parts, and then cutting away the placenta. In this way the ovary had to be removed.

The fœtus weighed 3 pounds 8 ounces, and was compressed and flattened. The weight of the placenta was 28½ ounces; the cord was shrivelled, and the placenta seemed made up of placental tissue with extravasated blood between the tufts.

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### A Case of Removal of both Ovaries during Pregnancy.

Mr. Knowsley Thornton (*Lond. Obst. Trans.*) records a case where he removed both ovaries at the fourth month of pregnancy. The operation was

performed in the usual manner, the ligatures being placed on the pedicles as far from the uterus as possible. This was done with the intention of avoiding the metrostaxis which usually comes on when both ovaries and tubes are removed, as it might hence set up abortion.

The patient recovered, and was delivered at the eighth month of gestation of a healthy child; the third stage was normal. Lactation was performed satisfactorily, although the uterus was atrophic four months afterward, and the mother had the usual menopause phenomena. The case further shows that the ovaries can have no influence in starting labor.

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### On Mercurialism in Lying-in Women undergoing Sublimate Irrigation.

Dakin, in the *Lond. Obst. Trans.*, 1886, makes a valuable contribution to the question of mercurialism following the use of corrosive sublimate as an antiseptic. As is now well known, Tarnier, in 1882, was the first to use this drug as an antiseptic in puerperal cases. The general outcome of its use has been a great diminution in the mortality and morbility of maternities, a result somewhat clouded by occasional cases of poisoning with even fatal results, as many as eight deaths having been reported. The cases known are as follows:

1. *Stadtfeldt's case.* One intrauterine injection, 1:1500, five days after labor. Death on eleventh day. Kidney and intestinal changes found.

2. *Somer's case.* Vaginal, 1:1000.

3. *Winter's case.* Intrauterine douche, 1:1000; vaginal afterward of 1:1000. Death on fourth day. Post-mortem, gangrenous colitis and peritoneal exudation.

4. *Vöhtz.* Intrauterine injection, 1:750, after abortion. Death on eleventh day after intestinal and kidney symptoms.

5. *Partridge.* Two intrauterine injections, 1:2000; dysenteric symptoms and death.

6 and 7. *Thorn.* Intrauterine douche after missed abortion, 1:1000; vaginal douche, 1:1000 in forceps case. Renal and intestinal lesions.

8. *Ziegenspeck.* Death on thirteenth day after three injections of 1:5000. No bad symptoms until second intrauterine douche on eighth day; patient died five days afterward.

9. *Netzel.* Intrauterine douche, 1:1500, on seventh day; abdominal pain then complained of; renal symptoms with albumen and lime salts in urine. Death on twenty-second day.

10. *Gustav Braun.* Douche during first stage; episiotomy performed during second stage, and intrauterine irrigation, 1:1000, after expulsion of placenta. Diarrhœa on third, and collapse on seventh day.

11. *Hofmeier.* One douche of 1:1000. Death on sixth day.

In all cases of douching Keller found mercury in urine, and also albumen.

Dakin then gives the results of the use of sublimate irrigation in 170 patients confined in the General Lying-in Hospital, London, under the charge of Dr. William P. Champneys. The sublimate is used as follows: Hands and instruments are disinfected with 1:1000; the vagina is douched after labor with 1:2000, two pints, at a temperature of 115°–120° F., being

used. For the first two days three pints of 1 : 2000 at 110° F. are employed, and then the strength is reduced to 1 : 4000. The patient occupies the dorsal posture, and after the douche is finished turns on her hands and knees, to evacuate any residuum.

Symptoms of poisoning usually appeared between the fourth and seventh days, and were usually diarrhœa, with blood and tenesmus, sometimes vomiting, patchy tongue, thirst and loss of appetite, fetor of breath, salivation with tenderness of teeth and gums, as well as red line on gums. The urine contained albumen in 11 of the cases.

Details of the one fatal case are given, with examination of kidneys.

He comes to the conclusion that a strength of 1 : 4000 is sufficient for douching.

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### Castration in Neuroses.

Schröder (*Zeitschrift für Geb. und Gynäk.*, Bd. xiii. Hft. 2) first points out that his disagreement with the views of Hegar in this question is only partial. With Hegar, he agrees in separating the cases where one removes diseased ovaries from those where the ovaries are removed to bring on the menopause. In the first class of cases the indications present no difficulty. No one can dispute that it is right to remove ovaries when diseased. The only point on which opinions can differ is as to whether the disease is severe enough to demand extirpation. This class, of course, includes ordinary ovariotomies, but one has as much right to remove a chronically inflamed ovary when dangerous to life or causing pelvic inflammatory mischief. When one ovary is thus affected, it alone should be removed; and it may be possible to remove only part of it. Schröder would, with Martin, include these with ovariotomy cases, thus separating them from castration.

The second class is quite different, as one must remove both ovaries completely; not because they are diseased, but to bring on the menopause. Schröder further points out that the effect of the removal of the ovaries or fibroids must be settled by experience, and criticises the view that neuroses are associated with pathological changes in the ovaries. Hegar admits that the nervous disturbance does not in any way agree with the severity of the pathological changes, but Schröder goes further, and alleges that the hitherto demonstrated changes, either clinical or anatomical, have nothing to do with general neuroses.

Schröder next points out the difficulty of diagnosticating minor changes in the ovaries, even with Schultze's method, and alleges (quite truly) that our knowledge of the pathological anatomy of the ovary, apart from tumor formation, is practically a blank, and that there is, therefore, entirely wanting a scientific basis for castration so far as the pathological changes in the ovary are concerned. Schröder has performed castration for neuroses ten times, but gives the result in only four, where the time since operation has been long enough to enable one to judge. He points out here that the immediate effect may be good, but that ultimately a relapse to the old condition takes place. The results in the four cases were good; no special pathological changes were found in the ovaries removed.

### A Case of Cured Peritoneal Tuberculosis.

Poten (*Centr. für Gynäk.*, Jan. 15, 1887) first draws attention to Hegar's monograph on genital tuberculosis, and to the statements in it as to the cure or arrest of diffuse miliary tubercle of the peritoneum by laparotomy. He points out that it must be shown in each case that the affection is really miliary tubercle, and not a granulating affection of some other sort. This can only be settled, of course, by the discovery of miliary tubercle and the bacillus tuberculosis on microscopic examination.

König, in some cases of peritoneal tuberculosis, treated with carbolic acid and iodoform, found miliary tubercle present on microscopic examination; but there is no information as to the presence of bacilli. Poten then records a case of peritoneal tuberculosis in a woman where bacilli were found. Frau K., twenty-nine years of age, had three children, the last a year and a half before. During the suckling of her youngest child had swollen limbs, which continued after weaning. Afterward swelling of the abdomen began, and also some prolapsus uteri. Weakness and wasting were also present.

On examination the abdomen was found markedly swollen, especially at and below the umbilicus. The abdominal walls were somewhat stretched, soft, and could be indented. Fluctuation was distinct, but there was no special hardness. On percussion the note was markedly tympanitic below the liver, dull between the symphysis and a point a hand's breadth above the umbilicus, as well as in the flanks and on change of position.

The anterior vaginal wall was slightly prolapsed, the uterus retroposed, movable, and with no evident tumor attachment. Fluctuation in Douglas's pouch doubtful per rectum. Diagnosis was thus difficult.

On abdominal section clear yellow fluid issued in a stream from the incision. The peritoneum and intestines were then seen to be covered with small nodules of a grayish-red color; uterus and ovaries unaltered in size, but also covered with nodules. All the fluid was removed, a piece of the peritoneum resected for microscopic examination, and the incision closed.

The patient recovered perfectly so far as the operation was concerned, and was, a year after the operation, in good health, with no tubercular affection apparent.

The piece of peritoneum removed was 2–3 mm. thick, and dense in consistence. On section it was grayish-red in color, with yellow specks. The free surface showed little prominences about the size of a millet-seed, and without ulceration; the sheen of the peritoneum was lost. In section perpendicular to the surface, one could see a cellular granulation tissue, which seemed toward the surface more like connective tissue. Tubercles, single and in groups, were present, and most abundant in the deeper layers of the thickened peritoneum; they form the miliary prominences at the surface already alluded to. They show the most varied forms, from simple granulation knots to developed wandering tubercle cells, with central caseation. Abundant fat cells lie near the tubercles and in the loose subserous tissue.

The demonstration of the bacilli was attended with difficulty. In many of the sections no bacilli could be found, but ultimately they were found, though sparingly, in some of the wandering cells. They were usually single, but in one cell two were noted.

## On Periuterine Hæmatocele.

Gusserow points out (*Arch. für Gynäk.*, Bd. 29, Heft 3) that of late years our knowledge in regard to hæmatocele has been increased by Kuhn, who showed that we could have extraperitoneal hæmatocele apart from the puerperium; by Gallam, who as early as 1855 pointed out that the greater number of hæmatoceles were due to burst tubal pregnancies; and finally, in regard to treatment, by the clinical work of Zweifel, Martin, and others.

Gusserow then takes up the consideration of eight cases of retrouterine hæmatocele on which he operated.

*Case I.* Frau E., thirty-six years of age, first menstruated when sixteen. The period was regular, and lasted two days; her last period was on September 11, 1885. She has had five children, the last in 1876. After an abortion in 1878 she had pelvic inflammation, which kept her in bed for six weeks. On March 1, 1885, bleeding came on, which lasted till November 7. Great abdominal pains came on then, especially at the right side, but diminished after a practitioner removed some membranous shreds. The pains, however, continued. On the 19th she had severe attacks when the bowels or bladder acted, and therefore sought admission to hospital on the 29th.

On abdominal palpation, the abdomen was soft and painful in both iliac regions. Through the abdominal wall one could feel a tumor on the right lower regions, with an upper convex border reaching as high up on the right as the anterior superior spine and navel. It did not reach as high in the middle line. The posterior fornix was bulged with an elastic tumor and the cervix pushed forward to the symphysis. The tumor could be felt on both sides of the uterus.

*Diagnosis.* Retrouterine hæmatocele. The pains increased, but there was no fever; the abdomen became tympanitic, and there was great difficulty in evacuating the bowels and bladder; while the tumor did not increase for three weeks, neither did it diminish. The posterior fornix was therefore incised, the patient being chloroformed, and a large quantity of black, broken-down blood, as well as fresh and old clots, washed out with salicylic acid. A drainage tube was then inserted, and the vagina packed with iodoform gauze. The patient improved decidedly after this, and the tumor diminished to the size of a child's head.

On December 26 the catheter for washing out passed toward the right into a compartment of the tumor, and evacuated 400 to 500 c. cm. of a dirty fluid, which clotted in part on exposure, contained much albumen, and red and white blood-corpuscles. The patient continued well till January 11, when the swelling again filled, and severe pains came on; menstruation was not present. Pulse 100°, temperature 38.2° C. By injection a considerable amount of fluid was evacuated on the 15th, but the patient's condition did not improve on the 28th. Abdominal section was performed, and the cyst-like walls of the sac stitched to the abdominal walls. A drainage tube could then be passed, and all secretion drained through the vagina. The patient improved until July 3, when she had all the symptoms and signs of perforative peritonitis, viz., distention, sickness, almost imperceptible pulse, etc. All this passed off under the free use of stimulants. Patient was practically well on March 4.

*Case II.* Frau D., thirty-seven years of age. Had nine children; an abortion in 1882, followed by pelvic inflammation. On December 18, 1885, had severe pain in abdomen, with uterine hemorrhage; on January 6 a tumor was felt through the left lateral fornix and in Douglas's pouch. Its upper boundary was above the pubis, and the uterus was to the front, though still retroflexed. Temperature normal.

The tumor was incised per vaginam, and the finger passed into the loose œdematous connective tissue. A considerable amount of dark blood was thus evacuated, and old blood clots removed with a blunt curette. No evidence of extrauterine pregnancy could be found. The edges of the sac were sutured to the vaginal incision, and the cavity packed with loose iodoform gauze. The gauze was removed in a few hours, and a drainage tube passed. Recovery good. Douglas's pouch free, uterus retroflexed and fixed somewhat to the right side. The other five cases are much like the preceding in their history, physical signs, and treatment. All the eight recovered.

The critical remarks given on these cases are as follows: Gusserow believes his cases to have been hæmatomata—*i. e.*, extraperitoneal effusions of blood. Case II. he believes to have been hæmatoma of the left broad ligament. In regard to the diagnosis of the hæmatoma of the broad ligament, he asserts that the important points are that the upper half cylindrical boundary can be felt while handling any tumor case—he felt it in Douglas's pouch. The lateral position of the tumor, and its mobility at first, are also valuable in pointing to this diagnosis. The remaining finger can be passed behind and in front of the swelling, but notes its lateral continuity with the uterus and pelvic wall.

In four of his cases Gusserow suspected extrauterine pregnancy as the cause of the effusion, but found no evidence of this in the blood evacuated. He points out that there need be no fear of septic infection by this operative interference and that by it pains, etc., are immediately removed and the patient cured in a period varying from twelve days to three weeks. The details are as follows: Case 1, cured in three weeks; Case 2, in three weeks; Case 3, in twelve days; Case 4, in eighteen days, etc.

The following was the method of opening the blood effusion. The vagina was first douched with corrosive sublimate solution 1:2000, and then the lowest point of the tumor punctured with a lancet-shaped knife, the incision being enlarged as required. The clots were then washed out with salicylic acid solutions and the walls of the cyst, when distinguishable, stitched to the vaginal mucous membrane. A thick drainage tube was inserted and the vagina tamponed with iodoform gauze.

Gusserow considers this method superior to treatment by laparotomy. He recommends operative treatment only in cases where absorption of the blood is delayed or where the local manifestations are severe.. The majority of cases of periuterine hematocele are cured with rest in bed.

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### On Cancer of the Uterus.

Williams, in his interesting Harveian lectures (*Lancet*, 1887), defines the term "cancer of the uterus" as meaning a new growth possessing malignant properties—*i. e.*, it possesses the power of invading neighboring tissues and of

reproducing itself in the form of secondary growths in other and distant parts. He recognizes three types of malignant disease, viz., sarcoma, adenoma, and carcinoma. Sarcoma is of the connective tissue type. Carcinoma and adenoma are of the epithelial type. This classification is not perfect, of course, as we may have what looks like a mixed form, and sarcoma may assume an alveolar form like adenoma.

The uterus is considered as divided into three parts, viz., the vaginal portion, the cervix, and the body. The portio lies projecting into the vagina; the cervix is bounded below by this and above by a plane passing through the portion where the characteristic cervical structure ends and the tubular glands of the uterus begin. This, of course, gives also the lower boundary of the body. Dr. Williams condemns rightly the use of the terms scirrhus, encephaloid, medullary, and epithelioma.

*Cancer of the portia vaginalis* is defined as beginning in the stratified epithelium on the vaginal surface or in the transitional epithelium at the os externum. He thus excludes sarcomata and glandular cancer. Eight cases are described in their clinical features and the microscopic examination of the parts removed given. The disease was found to begin at one or several points, not to spread into the cervical canal but to creep toward the vaginal wall, thus advancing superficially in seven of the cases. Seven of the cases were married, but they had less than the average number of children. The earliest symptom was hemorrhage.

Before taking up cervical cancer, the nature of the so-called erosion is considered. A true erosion is defined as being a surface with a structure like that of the mucous membrane of the cervical canal lying in the position usually occupied by squamous epithelium. It differs from cancer in that its epithelium is in single layer, and from adenoma in the glands being comparatively superficial. He believes such erosions to be produced by the glandular epithelium proliferating and then destroying and replacing the squamous epithelium beneath which they lie. The stroma around the glands is also active, being infiltrated with nuclei and small cells. The view advanced differs from that of Ruge and Veit, who hold that the glands in an erosion arise from a change in the deeper layer of the stratified epithelium.

Cancer of the cervix begins in the glands, which increase in number and grow where usually they do not exist. Their epithelial lining proliferates, becomes multiple-layered, and may fill the gland lumen. It may exist in a polypoid, papillary, or nodular form; the two latter forms passing into the substance of the cervix and connective tissue around it—the very worst direction possible from an operative point of view. They avoid encroachment on the uterine body and vaginal walls.

Cancer of the body of the uterus is either adenoma or true cancer, both growing from the gland epithelium. It spreads into the muscular coat and may open into the intestine, or cause inflammatory adhesions. The glands affected are those of the broad ligament or of the connective tissue anterior to the spinal column. In all the cases the disease begins after the menopause, the ages averaging from fifty-three to sixty-three.

Dr. Williams discusses finally the question of radical treatment, and advocates supravaginal amputation for cervical cancer as against total extirpation. For cancer of the body, of course, total extirpation is the only remedy.

### The Etiology, Pathology, and Classification of Salpingitis.

The question of the pathology of salpingitis has been a matter of controversy between Tait, of Birmingham, and Sänger, of Leipzig. We have no intention of judging between the two combatants, but merely summarize the excellent *résumé* of the classification and pathology of salpingitis given by Sänger in a letter addressed to the President of the Chicago Gynecological Society (*Amer. Journ. of Obstetrics*, March, 1887).

Sänger bases his pathology on the germ theory and the anatomical relations of the sexual organs. The genital tract from hymen to frimbriated end of Fallopian tube is exposed to access by organisms which may pass from the external medium to the tubes either along the mucous membrane or through the lymphatics; mischief may also pass from the peritoneal cavity into the tubes.

Various microörganisms have been found in the genital tract, but those considered the cause of disease (pathogenous microörganisms) are not many. Sänger classifies the forms of salpingitis into three groups, as follows:

Group I. *Forms of salpingitis produced by known specific microbes.*

1. Salpingitis gonorrhœica, produced by the gonococcus of Neisser.
2. Salpingitis tuberculosa, produced by the bacillus tuberculosis of Koch.
3. Salpingitis actinomycotica, produced by the actinomyces bovis of Ballinger.

Group II. *Forms of salpingitis due to specific microbes identical with those producing traumatic infection.*

1. Salpingitis septica.

Group III. *Forms of salpingitis produced by specific but as yet unknown microbes.*

1. Salpingitis syphilitica.

Group I. Gonorrhœal salpingitis is admitted by all as a form, the only point denied by some being whether the gonococcus of Neisser is the cause of it. All admit that gonorrhœa spreads to the tubes and sets up this form. Sänger shows that the tube becomes distended with pus, chiefly at the abdominal end, while the uterine end becomes thickened; the peritoneum becomes infected by the pus escaping through the ostium abdominale. Gonorrhœa produces only surface suppuration, and any abscesses in the psoas ligament or ovaries are usually septic.

It must not be forgotten that while Neisser's gonococci are found abundantly in the gonorrhœal pus from the cervix, their demonstration in the tubes is difficult, and in some cases of undoubted gonorrhœal salpingitis they have not been found.

Salpingitis tuberculosa is known chiefly through Hegar's work (Amer. Journ. Med. Sci. for April, 1887, p. 586), and is a distinct affection from the caseating pus of a pyosalpinx. This latter should be termed "coagulation necrosis."

Salpingitis actinomycotica is undoubtedly one of the greatest rarities in gynecology, but has been described by Zemann in his paper "Ueber die Aktinomycose des Bauchfells und der Baucheingeweide beim Menschen." In this case the tubes were dilated and purulent, with clumps of actinomyces present in the lumen of the tube and granulations in the walls. The fungus had passed from the intestines or vagina. [Descriptions of this fungus will be found in Klein's *Microörganisms* and Woodhead's *Pathology*.]

In the forms of salpingitis known as septica and syphilitica the evidence of their being due to a pathogenic microörganism is not yet complete. It must be remembered that the pathogenous microörganism of syphilis has not yet been discovered, and much has yet to be done in regard to those and septic conditions.

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### The Pathology of Chronic Inflammatory Disease of the Uterine Appendages as Illustrated by the Preparations of Sixty-three Cases removed during the Year 1886.

Mr. Lawson Tait gives, in the *Brit. Med. Journ.* of April 16, 1887, his views of the pathology of chronic inflammatory disease of the uterine appendages, as illustrated in a series of 63 cases operated on by him during 1886.

Mr. Tait recognizes five classes of cases as follows: First, catarrhal; secondly, those produced by the exanthemata at the time of puberty; thirdly, gonorrhœal cases; fourthly, those occurring from inflammatory mischief in the post-puerperal state; and lastly, cases where the uterus is infantile, and the appendages disorganized by inflammatory action.

The following are the statistics of the 63 cases: There was only one death. The gonorrhœal and post-puerperal cases preponderate, inasmuch as 53 of the women were married, and in 3 of the unmarried the cause was undoubtedly gonorrhœa. One case of double pyosalpinx followed the prolonged use of intrauterine pessaries intended to remedy an anteflexion.

In every case there was no possibility of the woman becoming pregnant, as in the majority the trumpet of the tube was found glued to the ovary; in others the fimbriæ were coalesced, the ovary remaining free.

In one-third of the cases the exanthemata, usually scarlet fever, had caused the inflammatory condition. The condition of the tubes varied. In the early stages they were intensely congested and friable; in the later cases the appendages were cirrhotic, and few Graafian follicles were present in the ovaries. The nature of the fluid contents varied, but was either cheesy or serous. He did not believe this had much bearing in determining the patient's sufferings; this was due to the adhesions.

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## MEDICAL JURISPRUDENCE AND TOXICOLOGY.

UNDER THE CHARGE OF

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### Statistics of Crime in Europe.

According to the journal *L'Italie* (*Annal. d'hygiène publique*, sr. 3, t. xvii. p. 57), the number of individuals, per 100,000 inhabitants, convicted of homicide is in Italy, 8.12; Spain, 7.83; Hungary, 6.09; Austria, 2.24; Belgium, 1.78; France, 1.56; Germany, 1.11; Great Britain, 0.60. In respect of

assaults, with injury to the person, Austria takes the first place with 248 per 100,000 inhabitants; Belgium, 177; Italy, 162; Germany, 129; France, 65; Hungary, 46; and Great Britain only 7. For criminal (immoral) assaults, the numbers are; Belgium, 15; Germany, 14; France, 10; Austria, 9; Hungary, 6.5; Italy, 4; Great Britain, 1.7; Spain, 1. In number of convicted thieves of all kinds, Germany takes the highest place with 222 per 100,000 inhabitants; Italy, 154; Great Britain, 147 (Scotland, 222); Belgium, 128; France, 112; Hungary, 77; Austria, 60; Spain, 56.

If the figures for the various crimes are added together for each country, it appears that Germany has the greatest amount of criminals, and Great Britain the least, among European nations.

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### Contribution to the Medico-legal Study of Footprints.

Masson (*Annal. d'hygiène publique*, ser. 3, tome xvi. pp. 336–345, 1886) gives the results of an investigation of a case of murder in which the footprints of the assassin were of importance. A woman was found murdered in an isolated house in the neighborhood of Constantine. On the floor of her chamber were observed seven blood-stained imprints of a naked foot, and that the right foot. Seven persons were suspected of the murder, and the footprints had therefore to be compared with the right feet of all of them. The presumption was that all the footprints were those of the foot of one individual.

The author regrets the meagre instruction on footprints in medico-legal text-books. Causse's well-known method of measuring footprints he did not find to be of much service in this case. The author divides the investigation of a footprint into three distinct operations: (1) the taking of the footprint; (2) its measurement; (3) the attentive study of its particular qualities or peculiarities, which give to each footprint a special physiognomy. In order to take the footprint of a suspected person, he is asked to step on some defibrinated blood, or a gummy solution of fuchsine, and afterward to stand or walk on a piece of stout paper, in order to obtain a print under both conditions. The prints are then measured by drawing a straight line along the inner edge of the print, touching the heel and ball of the great toe. Then another line, parallel to this, is drawn along the outer side of the print, and touching it. These lines are joined by three lines parallel to one another, but at right angles to the first lines. One of these lines touches the point of the great toe; another touches the hinder part of the heel; and a third passes across the foot immediately behind the ball of the great toe. The foot is thus enclosed in a rectangle, representing the greatest length and breadth of the footprint. It is important to note the distance between the back of the heel and the front of the print of the ball of the great toe. This measurement is less variable than the total length of the footprint. The maximal distance of the inner edge of the footprint from the inner tangential line is also to be measured, as an index of the height of the plantar arch. A line is to be drawn touching the points of the impressions of the second and fourth toes, and the height of the angle which this line, when extended, forms with the inner tangential line is to be noted. It varies much in different individuals.

Masson carefully studied the variations in the above measurements, as seen

in different prints of the same foot. He found in twelve subjects that the chief variations were as follows: 9 to 23 millimetres ($\frac{3}{10}$ to $\frac{9}{10}$ inch) in the length of the footprint; 0 to 8 millimetres ($\frac{3}{10}$ inch) in its maximal breadth; 0 to 5 millimetres ($\frac{2}{10}$ inch) in the measurement corresponding to the plantar arch; and 0 to 21 millimetres ($\frac{8}{10}$ inch) in the height of the angle of the toes. The extremes of the variations are met with in the prints from the foot standing, and those from the foot walking or running. He found that an added weight of forty pounds does not sensibly alter the footprint. In studying the physiognomy of the footprint, attention is to be paid to the marks of the toes, and especially to that of the great toe. In the latter, it is very important to distinguish the two parts of it; the anterior and larger corresponding to the mass of the toe, and the posterior and smaller (sometimes wanting) due to the flexor tendon. This smaller part varies much in different individuals. It is rarely absent from the print of the foot when walking, but may be so if standing. Applying these rules and considerations to the particular case in hand, Masson found a similarity between the footprints of blood on the floor of the chamber, and those of one of the suspected persons. Other circumstances afterward occurred to prove that this was the murderer.

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### Diagnosis of Death by Hanging.

Coutagne (*Arch. de l'anthropologie crim. et des Sciences pénales*, 15 Mai, 1886) believes, contrary to the view expressed by Jardieu, that the diagnosis of death does not depend essentially on the examination of the exterior of the body. The author especially insists on attention being paid to the internal lesions of the neck, which are generally more associated with judicial hanging than with suicidal hanging. Out of 24 autopsies of suicidal cases which he made, only 5 gave negative or doubtful results as regards the internal appearance of the neck. In 17 cases there was hemorrhage into the cellular tissue or into the muscles; in 10 cases there was rupture of the muscles; in 8 cases fracture of the hyoid bone; and in 8 cases fracture of the hyoid cartilage. He insists on the importance of examining the soft parts at the back of the neck. The lungs of hanged persons present some special characters, which Coutagne describes under the name of *carmine œdema*, and believes them to be dependent on an affection of the pneumogastric nerves.

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### The Medico-legal Significance of the Biperforate Hymen.

Prof. Demange, of Nancy, reports two cases of biperforate hymen, and both in married women; the one a young widow after six years of married life without children, the other a wife advanced in pregnancy. In the former case a fibrous band passed anterio-posteriorly dividing the vagina into lateral halves; in the latter the band passed transversely dividing the vagina into an anterior and into a posterior part. Demange felt satisfied that at least in the former of the cases the biperforate hymen was not the result of imperfect rupture during attempted coitus. He therefore agrees with Delens and Cornil, and differs from Tardieu, in believing that a biperforate hymen is generally a natural condition, and is not always, if even frequently, the result of attempted coitus.

### Spontaneous Closure of the Eyelids after Death.

Incited to the investigation by the paper of Galezowski on "The State of the Eyelids after Death," read before the Medico-Legal Congress in 1878, Dr. Valude has made a large number of observations on this subject (*Annal. d'hygiène publ.* ser. 3, t. xvii. pp. 168–172). The main question which he endeavored to answer was, At what time after death do the eyelids close spontaneously? His observations extended over one hundred bodies. He found that during the first twenty-four hours after death the eyes were completely closed in 7 of the cadavers. In 12 of these one eye was closed and the other was open. In 15 both eyes were widely open. In 66 the eyes were moderately open, or half closed. He never observed the eyes open spontaneously after they were closed, even though he observed the body for two or three days. In 50 cases, where the eyes were observed to be fully open or half open immediately after death, at a second inspection, some hours later, the eyes were found to have remained in the same condition in 21 of these, while in 23 the eyes had slightly closed. Only in one case was a half-open eye found next day to be widely open. This he considers quite exceptional, and attributes it to the probable interference of the physician who made the autopsy. He further states that if the eyelids had not begun to close before the expiration of forty-eight hours from death, they seldom closed during the two following days.

The author concludes (1) that in 10 per cent. of subjects the eyelids are closed at death; (2) that in 90 per cent. the eyelids are open or half open; (3) that in about 42 per cent. of the latter the eyelids do not change, while in 46 per cent. more or less complete closure gradually occurs. He believes it to be possible, from inspection of the eyelids, to say whether they had closed spontaneously or whether they have been closed by the hand of an assistant. A whitish mark of the finger is, in the latter case, left on the upper eyelid, which is difficult to describe but fairly easy to recognize.

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### Cicatrices of Leech Bites.

Dr. Castro, of Italy, states (*Annal. d'hygiène publ.*, ser. 3, t. xvii. pp. 48–50) that he recently had occasion to inquire into the presence of scars as the result of leech bites. He made thirty-seven experiments on different individuals, with the result that in several cases it was impossible to discover a scar by the naked eye. But in such cases the scar became evident after rubbing the skin with tincture of mustard, which reddens the skin surrounding the scar, leaving the scar white.

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### Cocainomania.

Erlenmeyer (*Deutsche Mediz. Zeitung*, 1886) presents us with a study of this new disease, analogous to morphiomania, and reports a large number of cases in which patients have had recourse to large doses of cocaine with the object of avoiding the morphine habit. The results of immoderate use of cocaine consist in symptoms of vascular paralysis, quick pulse, profuse sweatings, disturbed respiration, and syncope. Erlenmeyer points out the dangers to which such persons are subject if required to be anæsthetized by chloroform.

There is progressive emaciation, as in the case of morphiomania, the weight being lost to the extent of twenty or thirty per cent. The complexion becomes cadaveric, the eyes hollow, and the muscles flabby. Sleeplessness is a marked symptom. At an advanced stage psychical derangements manifest themselves, more especially of the nature of delusions as to persecution. Short of this there may be hallucinations of sight, with great intellectual depression, and with loss of memory. In some there is great prolixity in speech and in writing. Some of Erlenmeyer's patients had to be confined in a lunatic asylum. Erlenmeyer considers the prognosis of morphiomania to be very grave if it is associated with cocainomania.

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### Analogy between Dual Insanity and Dual Suicide.

Chpolianski (*Thèse de Paris*, 1885) points out the following analysis between dual suicide and dual insanity:

| *Dual Insanity.* | *Dual Suicide.* |
|---|---|
| 1. One subject is insane; he imposes his insanity on the other—*imposed insanity.* | 1. One subject has the intention of suicide; he imposes it on the other—*imposed suicide.* |
| 2. Two subjects become insane simultaneously under the influence of the same cause—*simultaneous insanity.* | 2. Two subjects intend suicide at the same time under the influence of the same cause—*simultaneous suicide.* |
| 3. Two subjects, equally predisposed, fall into the same fit of madness, but the one does so first, the other follows, compelled by the example of the first, and by predisposition—*communicated insanity.* | 3. Two subjects have the idea of suicide, but the one commits suicide first; the other, fascinated by the idea or the act of the first, commits suicide at the same time, or soon afterward—*communicated suicide.* |
| 4. An insane subject changes his ideas for those of a more intelligent madman—*transformed madness.* | 4. An eccentric subject has his ideas directed to suicide under the influence of a notorious suicide, or in troublous times—*transformed suicide, or epidemic suicide.* |

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### The Presence of Free Phosphoric Acid as a Proof of Poisoning by Sulphuric Acid.

Professor Garnier, of Nancy, investigated a case of poisoning by sulphuric acid, in which, though indubitable signs of the mode of death existed in marks on the clothing, and in the black carbonized condition of the alimentary canal, as also in the presence of a trace of arsenic—a common impurity of sulphuric acid—in the canal, and although the carbonized organs had a strong acid reaction, yet on extraction with alcohol and ether no reaction of sulphuric acid was obtainable from the extract. From a further investigation of the subject, Prof. Garnier believes that in such a case the sulphuric acid has acted on the phosphates normally present in the tissues, and displaced the phosphoric acid, the latter acid then becoming the free acid found in the alimentary canal. He gives several experiments in support of this view.

### Arsenic in Soil.

Professors Garnier and Schlagdenhauffen, of Nancy, recognizing the difficulty thrown in the way of the investigation of cases of arsenical poisoning by the ever-recurring suggestion that the arsenic found in the dead body has entered the body otherwise than in the form of poison, have made an experimental inquiry (*Annales d'hygiène publique*, ser. 3, t. xvii. pp. 28–37, 1887) into the subject. They divide the methods by which arsenic may enter the body in other form than poison into four groups: (1) the introduction of arsenic into the organism before death in the form of medicine, as Fowler's solution, in ordinary doses, or in the form of drugs containing a trace of arsenic as an impurity, as subnitrate of bismuth, sulphate of potash, etc.; (2) the introduction of arsenic, also before death, in foods and drinks, the organic matters from which these are prepared containing arsenic as an impurity—*e. g.*, sugar, confections, wine and beer; (3) the imbibition of arsenic by the dead body from the arsenical soil of the cemetery in which it is buried; (4) the imbibition of arsenic from the colored clothes in which the corpse may have been buried, or from the paint and metal mountings of the coffin.

The authors in their present investigation have confined themselves to the investigation of the third of these groups, and have made three sets of experiments, with the following results:

I. *Examination of soils naturally arsenical.* Arsenic is found disseminated in various soils in the Vosges in variable but often in considerable quantity, especially in red colored soils. The arsenic is present probably in the form of arseniate of iron. This salt is very slightly soluble in boiling water, but it is completely insoluble in water at the ordinary temperature of the soil. It cannot therefore be dissolved out by the percolating rain.

II. *Absorption of soluble arsenical compounds by non-arsenical soil in presence of water.* The soil chosen for this set of experiments was taken from the cemetery of Préville, Nancy. It was perfectly free from even a trace of arsenic. It is calcareous and of yellowish color, containing a considerable quantity of ferric oxide. A given quantity of the soil was mixed with twice its weight of distilled water, and to this was added a certain quantity of a weak solution of arsenious acid. A portion of the supernatant fluid was from time to time removed and tested for arsenic. It was found that after six or seven months the water contained no arsenic in solution. It had all become deposited in the form of arseniate of iron. Heat facilitated the disappearance of the arsenic.

III. *Diffusion of arsenic into a non-arsenical soil, in contact with soluble and insoluble compounds of arsenic.* Two ordinary graves were dug in the Préville Cemetery, side by side, one of which was afterward filled up and the other kept open. Four months later, cartridges made of white filtering paper, and containing each five grammes of arseniate of iron, arseniate of lime, or arseniate of potassium, were introduced by a boring process from the sides of the open grave into the surrounding soil and into the grave which had been filled up. At different periods subsequently the soil surrounding the cartridges were removed and examined for arsenic. No arsenic was at any time discovered except in the case of the soil surrounding the cartridges containing arseniate of lime, where a minute trace of arsenic was recognizable by Marsh's method.

The arseniate of potassium had disappeared, but had evidently been converted into insoluble compounds as soon as it came in contact with the surrounding soil. The authors conclude that the arsenical compounds met with in soil are not likely to diffuse themselves into the body of a buried person.

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### Mode of Action of Sulphuretted Hydrogen and Alkaline Sulphides.

Julius Pohl, in the *Archiv f. Experimentelle Pathologie u. Pharmakologie* (Bd. xxii. p. 1–25), gives the results of an investigation of the above subject, which he conducted in the pharmacological laboratory at Prague. His experiments were made on frogs and rabbits, and in two instances on dogs. Assuming that sulphuretted hydrogen, when it mixes with the blood, becomes converted into an alkaline sulphide, he employed a neutral solution of sulphide of sodium in nearly all his experiments, injecting it into the lymph-sac of the frog and the jugular vein of the rabbit and dog. The symptoms in the case of frogs, when a dose of 0.01 gramme (0.15 grain) was employed, were remarkably constant, and consisted of narcosis, central motor paralysis, slowing of the heart, with general enfeeblement of the cardiac muscle, ending with stopping of the heart in diastole. Fibrillar twitchings of the muscles were also observed. Death occurred in one and a half to two and a half hours, when a large dose was injected; in six or more hours when a smaller dose was given. In some cases rigidity of the muscles was observed. The poisonous symptoms in rabbits were not so constant as in frogs. In almost every case violent convulsions were present, with deep, labored breathing, plaintive cries, and slight tremors of the muscles. The convulsions were proved to be of cerebral origin. In the few cases in which convulsions were absent, a general and gradually increasing paralysis of the muscles was observed, with increased frequency of the respirations, and general exhaustion, ending in death. The lethal dose of the sulphide injected into the vein was about one and a half to two grains for an adult rabbit (about one-twentieth of a grain for each pound). Such a dose proves fatal in about an hour. The blood, though dark in color, contained oxy-hæmoglobin, and no sulph-hæmoglobin. In a few cases the hæmoglobin was reduced. The blood pressure rapidly sank, even after very small injections. This was probably due to the action of the sulphide on the vasomotor centres.

In order to ascertain whether the toxic action of the sulphide was due to its oxidized products, experiments were made with sulphite and hyposulphite of sodium, but although much larger doses than those of the sulphide were injected, no effect was observed on the blood pressure or otherwise. The toxic action, was, therefore, not due to oxidized products, nor was it caused by the sulphide abstracting oxygen from the blood; for the symptoms were not those of asphyxia, nor were similar symptoms observed when strong reducing substances were injected into the blood, such as hyposulphite of sodium, hypophosphite of sodium, phosphite of sodium, aldehyde, acetone, pyrogallol, etc. Some experiments were made by digesting the sulphide with defibrinated blood, and then injecting it into the jugular vein. A lethal result was still obtained, but the symptoms were somewhat different from those of the pure sulphide. The well-marked action on the blood pressure

was wanting. The author is, therefore, of opinion that the toxicity of the sulphide is due to its own action on the tissues, and not to the action of oxidized products or other transformations of it.

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## PUBLIC HEALTH.

UNDER THE CHARGE OF

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### Vaccination in Russia.

Dr. Ucke gives an interesting account of the present condition of vaccination in Russia. The benefits of vaccination, he says, are only now beginning to be realized by the peasants in Russia. As early as 1811 the Emperor ordered that all medical men should vaccinate; and that peasants, chosen from certain districts, should be educated in this particular at the cost of the community, and sent into the provinces to vaccinate. Annual reports were sent to the authorities, but it was soon shown that vaccination was not producing any effect on the smallpox epidemics which decimated the country. At first it was believed to be the lymph; but even though animal lymph was employed, the result was the same. It was then thought necessary that some control should be exercised over the vaccinators, and accordingly this work was added to that already occupying the medical inspector of each province. This again failed, and it was easily explained. In 63 provinces, each having an area of 1500 square miles, 5000 villages, and about 80,000 children, there was but one inspector, and he could only vaccinate at such times as the peasants were not occupied in cultivating their land—*i. e.*, in the winter time, an impossibility with such a climate as that possessed by Russia. Thus vaccination ceased to be enforced almost until 1881, when local self-government having been given to thirty-four provinces, it was determined to appoint a commission to consider the question of vaccination. The territory which it was thus proposed to deal with consisted of the whole of the central provinces of European Russia, with the exception of Poland, the Baltic Provinces, the country of the Cossacks, and the provinces of Archangel, Astrachan, and Orenburg, and it has an area of 51,444 square miles, about 53,000,000 of population, and probably 2,710,000 children amongst them. These 34 provinces are divided into 360 districts; each of these manages its affairs for itself, and up to 1864 there was only one hospital of twenty beds in each district, and a peasant vaccinator in each village. These hospitals were somewhat improved after this date, and the vaccination was left to dressers, instead of to the peasants; but there was no control over the medical inspectors, who, in some places, left everything to the dressers, in others allowed people to come to them, and in others sought them out in their own homes. The vaccination

report for 1882 stated that at least one-third of the children were unvaccinated, and probably that was not stating the whole truth.

The Commission was occupied first with the question of the production of lymph, then with vaccinators, and thirdly with arranging the plan by which vaccinations were to take place regularly, and how systematic control could be exercised over all vaccinations.

After but a short discussion, it was decided to use animal lymph on account of the prevalence of syphilis in Russian villages, and the fear that arm-to-arm vaccination would aid in spreading the disease. As but few doctors and dressers could maintain a supply of animal lymph, it was determined to keep up a central station, where vaccination could be efficiently taught and lymph obtained for distribution.

Hitherto, also in Russia, owing to the distances to be traversed, and the scarcity of medical men, vaccination was left to "dressers," and this the Commission considered must be continued, only that a medical man should control each of these people, and ascertain that his work was properly performed, and measures should also be taken to have them better instructed.

The system thus designed is for the priests in every district to send at a fixed period a list of all the children born during the past year. A list of the number of villages is sent to a dresser, with the dates when he is expected to visit. Upon his arrival at the first village he vaccinates a calf, and then goes to the next village, leaving directions for the management of the first calf, there he does the same, and also on the third day. The fourth day he returns to the first village, takes lymph, vaccinates the children, and continues his journey, so that in six days he has vaccinated in three villages, and has also obtained lymph sufficient for the next villages. In every village he leaves a report of whom he has vaccinated. As soon after as the pustules might be considered to be developed, the doctor arrives with two dressers; he is provided with lymph, in case of failure of those previously operated upon, and thus he examines and journeys through all the villages previously vaccinated by the dresser. The work is so arranged that only twenty-four days in the month are counted upon, because of possible hindrances, and only during nine months of the year, because of the work in the fields during the other three months. The number of medical men and dressers varies according to the size of the district and number of inhabitants to each mile. When the expedition is over, the lists of those vaccinated are written up and sent in to the authorities.

Thus it will be seen that the ambulatory system of medical attendance will be the most useful for a country like Russia, the only danger to be guarded against is the scarcity of medical men, not less than one for every hundred villages being necessary.

Besides, in journeying every year through the districts, the doctors will learn the habits, customs, and diseases of the inhabitants, they will have leisure to prescribe for and visit their patients, and the dressers will be useful in visiting patients and preparing medicines. Every medical man is to be provided with a medico-topographical list of questions, in order that he may obtain information from all the villages, and that which he fails to obtain one year may be asked for the following, until a perfect history of all districts can be collected.

What results this new vaccination legislation will produce can only be seen after many years of work.—*Deutsche Vierteljahrsschrift für öffentliche Gesundheitspflege*, Bd. xviii. Heft 3, 1886.

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### Influence of Smallpox Hospitals.

The Local Government Board of England have recently issued the report of their medical officer, Dr. George Buchanan, F.R.S., which contains a *résumé* of the evidence which has been adduced as to the influence of smallpox hospitals situated in London. Everyone of the five hospitals under the control of the Metropolitan Asylums Board, and also two others under different management, have given rise to smallpox in their neighborhood. The influence of the hospital at Fulham had been especially investigated by the Board's medical inspector, Mr. W. H. Power, and Dr. Buchanan now states that the whole of the experiences on record concerning the districts of London which are in special relations with smallpox hospitals, combine to form a very strong corroboration of the view of the Commission of 1881, that in the metropolis all smallpox hospitals share the disastrous ability of the Fulham hospital to spread smallpox by some means or other over the neighborhoods around them. This ability is now proved to extend to the distance of at least a mile, and to be independent of lines of human communication. It has now been shown to be exerted when the number of acute cases in a hospital has been restricted to twenty or thirty, and it was on one occasion exerted when only five acute cases were in the hospital together. It has not been extinguished, as Mr. Power's recent researches and the reports of health officers show, by the regulation of methods of transit, or by the removal of opportunities for personal communication with patients in the hospital.

It is to this influence of hospitals in maintaining smallpox over large areas of the metropolis, that must needs be ascribed a measure of that excess which has recently become conspicuous in the smallpox death-rate of London as compared with that of the provinces. This changed attitude of London toward the provinces, dating from the time when the former, and not the latter, became plentifully supplied with hospitals for smallpox, deserves especial consideration by any whose first thought is for the aggregate metropolis. For those whose concern is with the particular sections of London the facts will suffice that the five intra-urban smallpox hospitals in London have excess of smallpox around them, and that in the case of the hospital which has been especially studied (Fulham), this excess has amounted (during such portions of ten years as have seen the hospital at work, but not during other portions of the ten years when it was shut) to a threefold incidence of smallpox upon the three nearest square miles as compared with the incidence on the remainders of circumjacent districts. Dr. Buchanan therefore submits that the time has now come when the other means recommended by the Commission for "reducing the chance of spreading infection" ought to be tried.

The volume also contains, in appendix, a detailed memorandum on "Further Observation (1884–85) of the Influence of Fulham Smallpox Hospital on the Neighborhood Surrounding It," by Mr. W. H. Powers. The memorandum shows that when circles are drawn round the hospital having respectively a

quarter mile, half mile, three-quarter mile, and one mile radius, there has been the greatest incidence of smallpox upon that nearest to the hospital, and a less incidence on every successive ring in proportion as it is distant from the hospital; that this is equally true for each of the segments produced by dividing the area round the hospital by lines running from north to south and from east to west, and is further true when these lines are drawn from northwest to southeast, and from northeast to southwest. It should be noted that during the period when the hospital had this influence, every practical means had been taken for limiting the number of communications between the hospital and the outside world, and for rendering any danger to outsiders from such communications infinitesimal; an excellent ambulance service has been provided; and the number of sick in the hospital at any one time has been kept down even below the limit which the Hospital Commission regarded as permissible.

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### On the Etiology of Foot and Mouth Disease.

A valuable paper on this subject is communicated by Dr. E. Klein, F.R.S., to the same volume. He began his investigation by the examination of the organisms found in the tissue of the vesicle of the foot of the sheep. Two kinds of organisms were found in the diseased tissue: (*a*) bacilli of the size of tubercle bacilli, these stained in fuchsin after Gram's method, resembled the bacilli described by Gottstein and others as occurring normally in sebum in between the epithelial cells of sebaceous glands; (*b*) small micrococci occurring singly as dumb-bells, and particularly as longer or shorter chains or streptococcus; their number was not, on the whole, very large, but they were present in all the sections; they occur in the cavities of the vesicles and amongst the superficial parts as well as amongst the cell infiltrations of the deeper parts of the corium. They are found less abundant in the vesicle stage, more abundant in the formed ulcers, most abundantly in the superficial exudation of the ulcer of the mouth.

Inoculation of tubes containing sterile nutritive gelatine, or sterile agar-agar meat extract peptone, with lymph taken from a vesicle, led to definite results. In one gelatine and one agar-agar tube the growth on microscopic examination proved a motile bacillus; this, as it increased in number, liquefied the gelatine, and formed a pellicle on the surface. In size and other characters it was comparable to a small species of bacillus subtilis. In another gelatine tube, and in two other agar-agar tubes, the growth had altogether different characters, its progress was extremely slow, and after sixteen days' exposure to 36° C., the growth consisted of small collections of translucent, round, flat droplets or granules placed closely side by side. From one of these agar-agar tubes subcultures were established in a series of tubes containing gelatine, agar-agar, serum, sterile milk, sterile broth, meat extract solution with peptone (1 per cent.), and sterile broth with peptone (1 per cent.).

In the ordinary fluid media there appears as soon as twenty-four hours after incubation at 35° C. a very slight and uniform turbidity, which increases during the next few days; at the end of a week the growth has reached its maximum, but the turbidity is not at any time very great; before this point

is reached some growth begins to settle down as a white powdery mass, and after ten or twelve days or so the fluid has become quite clear, the whole having settled down. In sterilized milk it proceeds more slowly. A very remarkable difference exists between cultures in milk and in other fluid media; the growth in milk remains alive even after lapse of several months, in other fluid media, kept for three, four, or more weeks, the growth apparently becomes void of life. Microscopic examinations made of the growth from fluid media show it to consist of dumb-bell micrococci, diplococci, but chiefly of chains, streptococci, composed of 4, 6, 8, 12, 16, or more elements serially arranged.

Sheep, pigs, and guinea-pigs, inoculated with the streptococcus, did not suffer any noticeable illness; injection of a comparatively large quantity of the streptococcus into the cavity of the trachea in the case of two sheep and three calves failed to induce in these animals foot and mouth disease, but feeding four sheep with cultures of streptococcus induced in two of them the typical disease on the feet, a third animal showing lameness without other evidence of having contracted the malady; while the fourth remained well. On the other hand, certain guinea-pigs fed with the same streptococcus did not suffer from foot and mouth disease, but three of them died with disease of the stomach, which seemingly was of like nature in all cases. In two sheep the feeding of the streptococcus had to be repeated three times before one became infected. The symptoms of foot and mouth disease were well marked, and from the vesicle upon the foot of one of the sheep lymph was taken and used for the inoculation of culture tubes, each of which showed after a few days the characteristic growth of the streptococcus. It is noteworthy that five sheep previously inoculated did not suffer from foot and mouth disease when subsequently fed with the streptococcus, their immunity being in all probability due to their having been rendered refractory by the previous subcutaneous inoculation.

Dr. Klein adds, if a previous subcutaneous inoculation with the virus, though it does not effect any conspicuous disturbance of the general health, renders the animals experimented on thenceforward insusceptible to foot and mouth disease, a means would have been found to protect some animals at least against the virulent form of this disorder; but for a completely satisfactory settlement of the question, cattle as well as sheep require to be experimented on, since cattle are the most susceptible of animals as regards foot and mouth disease.

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### Epidemic of Enteric Fever at Pierrefonds.

Recently, Mons. Brouardel brought before the Académie des Sciences a report on the prevalence of enteric fever at Pierrefonds. He stated that during August and September of last year (1886) 23 persons inhabited three houses adjoining each other, of these, 20 were attacked with fever, and 4 died, 8 were seriously ill, while several hardly suffered at all. The three who were not attacked had only resided in the locality a short time. Previously, in July, one person had been seized with illness after occupying one of the houses, and from 1874 to 1883 this group of houses was five times visited by

enteric fever. The street where these houses are situated lies at the foot of a hill, and the drinking water is obtained from a bed of clay covered by a layer of porous sand, about two to three feet deep, and on which are built these houses. In order to procure the water, holes in the form of wells were dug to the depth of 2 to 3 feet. These wells were only distant 9 to 20 feet from leaking cesspools, some of which had not been emptied for 30 years; besides which, the rain-water from the roofs was conducted direct into these cesspools, so that after heavy showers they overflowed, and saturated the surrounding soil with excremental matter. But in order to demonstrate more clearly that the water was responsible for the outbreak of disease, samples were taken from different wells, and examined by MM. Chantemesse and Widal, of the Bacteriological Laboratory in Paris, who reported that they had found bacilli resembling those which Eberth, Gaffky, and others considered to be the enteric fever bacillus, and these were found alive one month after the outbreak. The spleen of one of the patients was punctured, and blood from it also produced colonies of bacilli similar to those in the water. The water from the wells was also chemically analyzed, and that which came from the house where the bacilli were most numerous, contained least evidence of pollution, there being only 8 to 9 milligrammes of organic matter in a litre.

M. Brouardel's conclusions were that the earth does not destroy the germs of enteric fever; that they existed more than a month in the water of one of the wells at Pierrefonds; he states, however, that organic matter may be entirely destroyed if it comes in contact with any alkali.—*Journal de Hygiène*, No. 544, p. 93.

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### Treatment of Sewage.

Mr. Crump and Mr. Dibdin read papers on the treatment of sewage at a meeting of the Institution of Civil Engineers in London, in which the former pointed out that filter presses afford a ready solution to the question of the disposal of the sloppy mass of putrescent mud daily produced in sewage precipitation works, and that a practically inodorous manure might be obtained, more valuable for crops of hay, potatoes, Swedish turnips, etc., than any farmyard manure. Mr. Dibdin, however, in his paper, though considering that sewage sludge presses are useful in converting the material into a portable form, did not believe that they would ever be really successful except for small quantities; the cost, also, is an almost insuperable obstacle. He believed the furnace, rather than the farm, will be found the most suitable way of disposing of unwholesome matter. In some places, where the quantity is small, it can be mixed with freshly slacked lime, and then run out on to porous beds, where after a few days, it will be found hard enough to cut with a spade and remove; or, as in Southampton, where dry road sweepings are mixed with semi-liquid sludge, and made suitable for the use of the farmer. But with regard to London, the only plan that seemed likely to succeed would be to carry the sludge out to sea, no expense would be incurred in pressing; the sludge need not be visible at all, it could be precipitated in covered tanks, pumped into vessels, and discharged under water, far from land,